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NATIONAL DAM SAFETY PROGRAM. CREAM RIDGE DAM (NJ00252), DELAWAR--ETC(U)
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DELAWARE RIVER BASIN
LONG BOG RUN
MONMOUTH COUNTY
NEW JERSEY

LEVEL

CREAM RIDGE DAM
NJ 00252

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

DEPARTMENT OF THE ARMY
Philadelphia District
Corps of Engineers
Philadelphia, Pennsylvania

April, 1979

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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Storch Engineering
220 Ridgedale Ave.
Florham Park, NJ 07932

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Cream Ridge Dam, N.J.

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE—2 D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

IN REPLY REFER TO

NAPEN-D

Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, New Jersey 08621

30 APR 1979

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Cream Ridge Dam in Monmouth County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given in the front of the report.

Based on visual inspection, available records, calculations and past operational performance, Cream Ridge Dam, initially listed as a high hazard potential structure but reduced to a low hazard potential structure as a result of this inspection, is judged to be in good overall condition and the spillway is considered adequate. The low hazard potential classification means that in the event of failure of the dam, no loss of life and only minimal economic loss is expected. However, to assure the continued functioning of the dam and its impoundment, the following remedial actions could be undertaken by the owner:

a. Initiate a program of periodic monitoring of seepage on the downstream slope.

b. The toe drain should be inspected and cleaned or reconstructed as necessary.

c. Remove trees and brush on the south end of the embankment to lessen the piping potential.

d. Repair the eroded area at the downstream end of the auxiliary spillway.

e. Remove riprap blockage at the downstream end of the stilling basin at the discharge culvert outlet. Install a new riprap apron with

properly sized stone to prevent future scour.

f. The owner should upgrade the operating and maintenance procedures by issuing a manual and check list for recommended procedures. Inspection and maintenance visits should be logged. Records of pond levels should be kept during routine visits and during severe storms. An annual site inspection should be conducted using a visual inspection check list similar to the one used in this report.

A copy of the report is being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congressman Frank Thompson of the Fourth District. Under the provisions of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, five days after the date of this letter.

Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia 22161 at a resonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

An important aspect of the Dam Safety Program will be the implementation of the recomendations made as a result of the inspection. We accordingly request that we be advised of proposed action taken by the State to implement our recommendations.

Sincerely,

1 Incl
As stated

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

Copies furnished:
Dirk C. Hofman, P.E., Deputy Director
Division of Water Resources
N. J. Dept of Environmental Protection
P. O. Box CN029
Trenton, NJ 08625

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Trenton, NJ 08625

CREAM RIDGE DAM (NJ00252)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 7 December 1978 and 2 February 1979 by Storch Engineers under contract to the State of New Jersey. The state, under agreement with the U. S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92-367.

Cream Ridge Dam, initially listed as a high hazard potential structure but reduced to a low hazard potential structure as a result of this inspection, is judged to be in good overall condition and the spillway is considered adequate. The low hazard potential classification means that in the event of failure of the dam, no loss of life and only minimal economic loss is expected. However, to assure the continued functioning of the dam and its impoundment, the following remedial actions could be undertaken by the owner:

a. Initiate a program of periodic monitoring of seepage on the downstream slope.

b. The toe drain should be inspected and cleaned or reconstructed as necessary.

c. Remove trees and brush on the south end of the embankment to lessen the piping potential.

d. Repair the eroded area at the downstream end of the auxiliary spillway.

e. Remove riprap blockage at the downstream end of the stilling basin at the discharge culvert outlet. Install a new riprap apron with properly sized stone to prevent future scour.

f. The owner should upgrade the operating and maintenance procedures by issuing a manual and check list for recommended procedures. Inspection and maintenance visits should be logged. Records of pond levels should be kept during routine visits and during severe storms. An annual site inspection should be conducted using a visual inspection check list similar to the one used in this report.

APPROVED: James G. Ton

JAMES G. TØN
Colonel, Corps of Engineers
District Engineer

DATE: 30 April 1979

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Cream Ridge Dam, NJ00252
State Located:	New Jersey
County Located:	Monmouth
Drainage Basin:	Delaware River
Stream:	Long Bog Run (tributary of Crosswicks Creek)
Date of Inspection:	December 7, 1978 and February 2, 1979

Assessment of General Condition of Dam

Information available for this study is adequate to permit a Phase I assessment of the dam and appurtenances. Based on available records, past operational peformance, a visual inspection and Phase I engineering analyses, Cream Ridge Dam is assessed as being in good overall condition; outwardly structurally stable and hydraulically adequate to accommodate the SDF (Spillway Design Flood).

Unsatisfactory conditions observed during the field inspection consist of two seepage areas on the downstream embankment slope on the south side of the dam, scoured riprap apron at the discharge culvert outlet, and minor erosion at the downstream end of the auxiliary spillway.

It is recommended that the following measures be undertaken by the owner in the near future:

1) The toe drain should be inspected and cleaned or reconstructed as may be necessary to insure proper operation.

2) The eroded area at the downstream end of the auxiliary spillway should be filled, compacted and stabilized with ground cover vegetation.

3) Remove riprap blockage at downstream end of the stilling basin at discharge culvert outlet. Install new riprap apron with properly sized stone to prevent future scour.

4) Trees and brush on the south end of the embankment should be cut off at the ground surface with minimal disturbance of the existing ground. The area should be stabilized with ground cover vegetation.

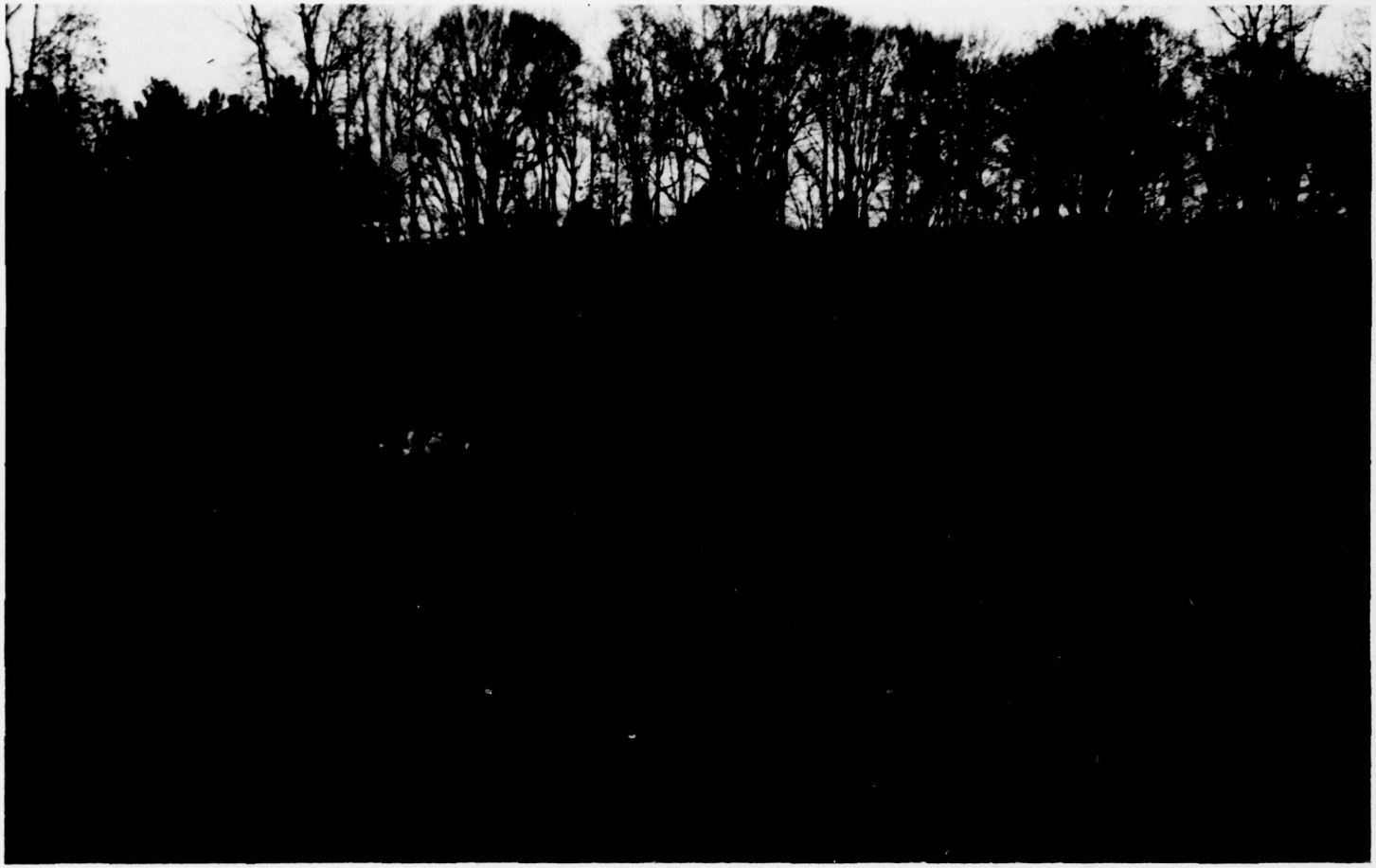
The owner should initiate a formal program of annual inspection and maintenance with special attention given to the toe drain to assure proper drainage of the embankment without seepage. These inspections should be performed by a qualified professional engineer and the observations and measurements should be recorded on standardized check-list forms. Inspection check-lists, complete records of maintenance and design calculations plus construction drawings for post construction changes should be included in a permanent file, available for public inspection. Annual maintenance should include: removal of brush and trees from the embankment; repair of the riprap apron at the discharge culvert outlet; repair of erosion at the downstream end of the auxiliary channel and repair and cleaning of the toe drain.

A qualified professional engineer should be engaged soon to monitor the seepage on the downstream slope by visual observation and measurements on a monthly basis to determine the source and seriousness of the seepage. The present toe drain system should be investigated to determine its adequacy. A detailed topographic survey of the

dam and surrounding areas should be performed by a qualified professional engineer or licensed land surveyor. The survey information, observations and measurements should be studied thoroughly and recorded on copies of the original construction drawings to provide a convenient reference and included in the permanent record.

Richard J. McDermott

Richard J. McDermott, P.E.



OVERVIEW PHOTO - CREAM RIDGE DAM

7 DEC. 1978

TABLE OF CONTENTS

TABLE OF CONTENTS (cont.)

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 30214. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. It is important to note that the condition of dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that the unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

CREAM RIDGE DAM, I.D. NJ00252

SECTION 1: PROJECT INFORMATION

1.1 General

a. Authority

Public Law 92-367, August 8, 1972 authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The Division of Water Resources of the New Jersey Department of Environmental Protection (NJDEP) in cooperation with the Philadelphia District of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the State of New Jersey. Storch Engineers has been retained by the NJDEP to inspect and report on a selected group of these dams. The NJDEP is under agreement with the Philadelphia District of the Corps of Engineers.

b. Purpose of Inspection

Visual inspections of Cream Ridge Dam were made on December 7, 1978 and February 2, 1979 to generally assess the structural integrity and operational adequacy of the dam and appurtenances.

1.2 Description of Project

a. Description of Dam and Appurtanences

Cream Ridge Dam is an earthfill dam (see Overview Photo and Plates 4 and 5) with two uncontrolled outlets and one outlet works. The principal spillway (see Photo 1) is a corrugated metal pipe riser with a horizontal outlet pipe (see Photo 2). The auxiliary spillway is a grassed overflow channel.

The embankment extends north/south and is approximately 280 feet long. The embankment crest at elevation 95.8 (MSL) is 15 feet wide and the sides slope down at 3:1 upstream and 2:1 downstream. The embankment surfaces are covered with a thick stand of grass (see Photos 3 and 4). An earthfill cutoff trench is located along the length of the embankment, approximately at its centerline. A toe drainage trench is located about 15 feet upstream of the downstream embankment toe.

The principal spillway is located about 40 feet upstream of the centerline of the embankment crest and consists of a verticle corrugated metal pipe riser 72 inches in diameter yielding a circumferential weir crest length of about 18 feet at elevation 89.5, 6.3 feet below the top of the dam. The top of the spillway riser is surrounded by a timber anti-vortex device (see Photo 1). This device also serves as a trash rack mounting assembly and safety barrier. The riser invert is at elevation 72.0. The spillway discharges through a horizontal corrugated metal pipe, 36 inches in diatmeter, which extends from the riser to the downstream toe of the dam. The discharge culvert invert is at elevation 72.0. At the downstream end of the culvert the discharge flows into a small pool.

The outlet works consists of a manual slide gate controlled corrugated metal pipe, 15 inches in diameter, which discharges into the corrugated metal pipe riser. The outlet pipe is horizontal with its invert at elevation 72.5 and extends from a point outside of the upstream toe of the embankment to the riser. The upstream end of the pipe is set in a concrete headwall. The slide gate is mounted on the headwall with a freestanding stem.

The auxiliary spillway is located to the north of the earth embankment and consists of a trapezoidal grassed channel with 3:1 side slopes and a bottom width of 30 feet (see Photo 5). The inlet channel slopes up at about 0.02 ft./ft. to a concrete sill at elevation 93.2. The outlet channel slopes at 0.029 ft./ft (field measurement) down to a steep embankment on the north side of the natural downstream channel.

b. Location

Cream Ridge Dam is located at the east end of Cream Ridge Pond in the Cream Ridge Section of Upper Freehold Township, Monmouth County, New Jersey (see Plates 1 and 2). Overflow from the pond enters Long Bog Run a tributary of Crosswicks Creek.

Cream Ridge Dam is located on land owned by Rutgers, The State University. The surrounding lands are used by the University's Department of Horticulture and Forestry for research.

c. Size and Hazard Classification

Size and Hazard Classification criteria presented in "Recommended Guidelines for Safety Inspection of Dams", published by the U.S. Army Corps of Engineers are as follows:

SIZE CLASSIFICATION

	Impoundment	
Category	Storage (Ac-ft)	Height (Ft)
Small	<1000 and ≥ 50	<40 and ≥ 25
Intermediate	≥ 1000 and $<50,000$	≥ 40 and <100
Large	$\geq 50,000$	≥ 100

HAZARD POTENTIAL CLASSIFICATION

Category	Loss of Life (Extent of Development)	Economic Loss (Extent of Development)
Low	None expected (no permanent structures for human habitation)	Minimal (Undeveloped to occasional structures or agriculture)
Significant	Few (No urban developments and no more than a small number of inhabitable structures)	Appreciable (Notable agriculture, industry or structures)
High	More than few	Excessive (Extensive community, industry or agriculture)

The characteristics of Cream Ridge Dam are:

Storage = 144 acre-feet (Top of Dam)

Height = 24 feet

Potential Loss of Life: No inhabitable structures within 2 miles of dam in downstream flood plain.

Potential Economic Loss: Crop damage in agricultural areas. Secondary road 4000 feet downstream.

Therefore, Cream Ridge Dam is classified as "Small" size and "Low" hazard potential.

d. Ownership

Cream Ridge Dam is owned and operated by Rutgers, The State University, New Brunswick, N. J.

e. Purpose of Dam

Cream Ridge Dam impounds water used as an irrigation supply for agricultural research performed by the University's Department of Horticulture and Forestry, which is consistent with the filed Application for Permit for Construction or Repair of Dam made by Rutgers in 1970.

f. Design and Construction History

Records on file with NJDEP include; design calculations for the hydraulic characteristics of the outlets and structural design for the anti-vortex device assembly, construction plans and specifications and construction inspection reports for the original 1971 construction. The calculations and plans were prepared by the Soil Conservation Service, USDA in 1970. The construction inspection reports were prepared by NJDEP engineers and relate satisfactory construction procedures.

Two changes were made in the appurtenances of the dam prior to completion of construction: a concrete headwall was added to the 15 inch diameter inlet pipe to improve the stability of the gate valve and a concrete invert was poured in the riser pipe to provide extended life and a larger factor of safety against buoyancy.

One annual report on the condition of the dam was on file, dated August 1972, which indicated difficulty in growing grass on the embankment slopes due to acid soil conditions. No further annual reports were available, however, the December 1978 and February 1979 inspections indicated that the embankment crest and slopes, and the auxiliary channel were as shown on the Construction Plans and had a thick grass cover.

g. Normal Operational Procedures

The dam and appurtenances are maintained by Rutgers, The State University. There is no fixed schedule for maintenance. The Department of Horticulture and Forestry provides maintenance of the facilities on an "as-needed" basis, which generally consists of debris removal from the trash racks around the top of the riser. The timber deck on the anti-vortex device was replaced in July 1978.

The slide gate controlled 15-inch diameter pipe is used to drain the pond to facilitate maintenance and debris removal. This outlet is not used as an emergency blow-off during storms. The pond was reportedly drained one time in 1974 to check the riser, outflow pipe and sediment collection. All were found to be satisfactory.

1.3 Pertinent Data

a. Drainage Area= 1.4 square miles

b. Discharge at Dam Site

Maximum known flood at dam site	Unknown
Outlet works at pool elevation	12 cfs
Diversion tunnel low pool outlet at pool elevation	N.A.
Diversion tunnel outlet at pool elevation	N.A.
Gated spillway capacity at pool elevation	N.A.
Ungated spillway capacity at top of dam (Principal Spillway)	155 cfs
Ungated spillway capacity at top of dam (Auxiliary Spillway)	452 cfs
Total spillway capacity at top of dam	607 cfs

c. Elevation (Feet above MSL)

Top of Dam	95.8
Maximum pool-design surcharge	95.8
Full flood control pool	N.A.
Recreational pool	N.A.
Principal spillway crest	89.5
Auxiliary spillway crest	93.2
Upstream portal invert diversion tunnel	N.A.
Stream bed at centerline of dam	72.0
Maximum tailwater	74.2

d. Reservoir

Length of maximum pool	4500 feet
Length of normal pool	2200 feet
Length of flood control pool	N.A.

e. Storage (Acre-feet)

Principal spillway pool	85
Recreational pool	N.A.
Flood control pool	N.A.
Design surcharge	144
Top of dam	144

f. Reservoir Surface (Acres)

Top of dam	16
Maximum pool	16
Flood control pool	N.A.
Recreational pool	N.A.
Principal spillway crest (Elev. 89.5)	9

g. Dam

Type	Earthfill w/toe drain
Length	280 feet
Height	24 feet
Sideslopes - Upstream	3 horiz. to 1 vert.
- Downstream	2 horiz. to 1 vert.
Zoning	None
Impervious core	None
Cutoff	Earthtrench
Grout curtain	None

h. Diversion and Regulating Tunnel N.A.

i. Principal spillway

Type	72" Diameter Corrugated Metal Pipe Riser
Length of weir (Circumferential)	18 feet
Crest elevation	89.5
Gates	None
Upstream channel	N.A.
Downstream channel	36" Diameter Corrugated Metal Discharge Culvert

j. Auxiliary Spillway

Type	Trapezoidal grassed channel with concrete sill at crest
Length of weir	30 feet (bottom width at concrete sill)
Crest elevation	93.2
Gates	None
Upstream	0.020 feet/foot(Design)
Downstream	0.029 feet/foot (Field Measurement)

k. Regulating Outlets (Outlet Works)

Type	15" Diameter Corrugated Metal Pipe
Invert Elevations	
Upstream	72.5
Downstream	72.5
Gate	Manual Slide Gate

SECTION 2: ENGINEERING DATA

2.1 Design

Design calculations, construction drawings and specifications for the original construction in 1971 were available from the NJDEP. The calculations consist of the hydraulic design for the principal and auxiliary spillways, reservoir staging and the structural design for the timber anti-vortex device assembly.

The following construction drawings dated June 1970 are available for the dam construction:

1. Cover Sheet
2. Plan of Pool Area
3. Plan of Dam and Pool Area
4. Plan and Profile of Dam
5. Riser Details
6. Cross Section of Dam and Spillway

The design calculations and contract drawings for the dam and appurtenances were prepared by the Soil Conservation Service (SCS), U.S. Department of Agriculture. The calculations indicate a design storm peak inflow of 580 c.f.s. Copies of the hydraulic design calculations for the spillway prepared by the SCS are contained in Appendix 3.

The principal spillway was analyzed as a sharp-crested weir and the discharge culvert was analyzed as an outlet controlled culvert. Under design storm conditions the discharge culvert

controls discharge through the principal spillway.

The auxiliary spillway was analyzed as a trapezoidal channel with critical flow. Based on these analyses the spillway facilities at Cream Ridge Dam would pass the design storm flow of 580 c.f.s. while maintaining 1 foot of freeboard in the pond. It should be noted that at the time this facility was designed, it was reportedly standard practice of the agencies involved in the design to size combined spillway facilities so that about 80 percent of the design storm flow would pass through the principal spillway and the remainder would be accommodated by the auxiliary spillway. In the case of Cream Ridge Dam the principal spillway passes about 20 percent of the design flow with 80 percent passing through the auxiliary spillway.

2.2 Construction

The facilities at Cream Ridge were constructed during the spring and summer of 1971. Monthly construction inspections were performed by Mr. S. A. Aziz of NJDEP throughout the construction phase from the initial excavation to the final seeding of the embankment slopes and crest. Inspections were performed on; April 21, May 14, June 26, and July 25 in 1971. All of the reports on file indicate that the work performed was satisfactory. Inspection reports are on file with the Bureau of Flood Plain Management, 1474 Prospect Street, Trenton, N.J.

2.3 Operation

The approval of the application to construct Cream Ridge Dam was subject to a number of conditions. One of the requirements was that annual condition reports, including photos, be submitted to the NJDEP. One such report is on file dated August, 1972,

which indicates that an acid soil condition in the embankment slopes and in the auxiliary spillway area prevented germination of seeding. It was also indicated that measures were being taken to remedy this situation and reseeding was planned.

2.4 Evaluation

a. Availability

Engineering information referenced above is contained in the NJDEP file and is available for inspection at the offices of the Bureau of Flood Plain Management, 1474 Prospect Street, Trenton, N.J.

The Farm Superintendent (owner's representative responsible for facility) indicated that no formal records were available for the facility at the Cream Ridge Headquarters.

b. Adequacy

The engineering data available in the NJDEP files are adequate to perform a Phase I assessment of the hydraulic capacity of the spillways. Data available were not adequate with respect to Phase I assessment of the structural stability of the dam.

c. Validity

Based on the findings of the field inspection it is apparent that the information on file for the Cream Ridge Dam is essentially accurate with respect to the as-built conditions at the site. It was noted however, that the hydraulic analysis of the auxiliary spillway does not include channel entrance losses that would yield lower discharge rates for the water surface elevations analyzed (See Appendix 4 and Section 5).

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General

Inspections of the Cream Ridge Dam were undertaken on December 7, 1978 and February 2, 1979 by members of the staff of Storch Engineers. A copy of the visual inspection check list is contained in Appendix I. The following procedures were employed for the inspection:

1. The embankment, appurtenant structures and adjacent areas were examined.

2. Seepage zones were located and described.

3. The embankment and accessible appurtent structures were measured and key elevations determined by hand level.

4. The embankment, appurtent structures and adjacent areas were photographed.

b. Dam

The upper portion of the dam and auxiliary spillway appeared to be stable with no localized depressions, wild life burrows nor other signs of distress. The exposed upstream and downstream slopes were covered with thick grass.

Two small seepage zones were noted on the south side of the dam during the inspection (see Plate 4 and Photos 8 & 9). The northerlymost zone was located at the interface of the earthfill embankment and the natural embankment. The ground surface in this area was soft and wet at the toe of the downstream embankment slope and up the slope for a height of about 8 feet. This entire area was covered with thick grass.

The second seepage area was located along an eroded drainage gully in the natural slope to the south of the dam. Apparently, this gully existed prior to construction of the dam. Light flow was observed from a point about 15 feet below the top of the dam in an area covered with trees and brush.

Both seepage zones drain into a small natural channel which joins the discharge from the principal spillway and continues down to Crosswicks Creek. The outlet for the toe drain could not be located.

Generally the surface soils at the dam site consist of silt and sand with some clay and significant organic material near the surface(see Plate 3). These surface deposits were eroded from deeper strata formed during the Cretaceous Period. Underlying soils are silt, silty sand, sandy silt, and very fine sand, known as Mount Laurel and Wenonah Sands or dense silt, clay and sand with cemented layers, known as Hornertown Marl. Bedrock is usually more than 100 feet below the surface.

c. Appurtenant Structures

Principal Spillway

The exposed portion of the corrugated metal riser pipe which forms the inlet for the principal spillway appeared to be in good condition with no signs of corrosion or damage.

Auxiliary Spillway

The upstream portion of the auxiliary spillway was grass lined and in good condition with no signs of erosion. The concrete sill which forms the crest of the auxiliary spillway was grass covered over most of its width and was in good condition. The downstream spillway channel was in good condition down to its outlet where the steep embankment extending down to the natural channel was eroded, (see Plate 4 and Photo 6).

Anti-Vortex Device Assembly

The structural timber members located above the water level were in good condition. The exposed hardware and the galvanized conduit trash rack along the four sides of the structure were also in good condition with no signs of corrosion. The submerged portions of the structure were not inspected.

Outlet Works

The outlet works were completely submerged and therefore could not be observed. The control mechanism for the

gate valve was not readily accessible at the time of inspection and therefore the operation of the mechanism could not be checked.

Discharge Culvert

Most of the discharge culvert is contained within the embankment and could not be inspected. The exposed portion of the pipe at the downstream toe of the embankment consisted of a 36-inch diameter corrugated metal pipe in good condition, however a small stilling basin has developed at the downstream end of the culvert and the riprap apron indicated on the construction drawings has been scoured away.

d. Reservoir Area

Cream Ridge Pond is a long narrow body, about 200 feet in width with an overall length of approximately 2200 feet. The surrounding land area is predominately agricultural with some areas remaining in a natural wooded state (see Photo 7).

The surrounding land area slopes gradually downward toward the pond, with a maximum relief of approximately 55 feet above the average pond elevation. The immediate shoreline areas are generally in a natural wooded condition with no structures, such as docks or bulkheads.

e. Downstream Channel

The remains of the riprap apron at the discharge culvert outlet encircle the stilling basin that has developed

with a major collection of stone forming a pervious retarding structure at the downstream outlet. A natural channel extends from this basin to Long Bog Run. The natural channel is about 10 feet wide and 2 feet deep with steep side slopes extending up to a broad flat flood plain. The downstream lengths of Long Bog Run and Crosswicks Creek are in a natural state with trees and shrubs along both banks. For the most part, there are no residential, commercial or industrial structures in the downstream flood plain. Land use is generally agricultural. A secondary road crosses the channel about 4000 feet downstream from the dam.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures

The water level in Cream Ridge Pond is naturally controlled by overflow discharge at the principal spillway which has a fixed crest elevation. During intense storms additional discharge occurs through the auxiliary spillway to the north of the dam.

The water level is lowered as required for maintenance and repairs through the use of the outlet works.

4.2 Maintenance of the Dam

No regular maintenance or inspection procedures have been established for this facility. Maintenance is performed on an "as-needed" basis by the Department of Horticulture and Forestry, Rutgers, The State University.

The most recent maintenance of the pond and dam was reportedly performed in July 1978. This work consisted of replacing deteriorated timber decking, stringers and hardware forming the upper portions of the anti-vortex device assembly. The pond was not drained at that time.

4.3 Maintenance of Operating Facilities

The slide gate on the outlet works is maintained by the Department of Horticultural and Forestry, Rutgers, The State University. The date of last use or servicing of this device is uncertain.

The downstream end of the auxiliary spillway has experienced erosion. There was no evidence of past maintenance in this area.

4.4 Description of Any Warning System in Effect

There is no warning system for the dam and there is reportedly no program of periodic monitoring of the lake level during intense storms.

4.5 Evaluation of Operational Adequacy

The dam and appurtenant structures at Cream Ridge have performed satisfactorily since the filling of the impoundment in 1972. Reportedly, there has been no overtopping of the dam. The auxiliary spillway has reportedly experienced flow twice since 1972.

Maintenance documentation is poor, but judging from the field inspection observations maintenance has been adequate.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data

Size and hazard classification were used in conjunction with "Recommended Guidelines for Safety Inspection of Dams" published by the U.S. Army Corps of Engineers to establish the SDF (Spillway Design Flood) for Cream Ridge Dam. The appropriate design range for this facility is 50-year to 100-year frequency storm. Although the characteristics for Cream Ridge Dam as described in Section 1, fall into the lower end of the prescribed categories, it is deemed prudent to select the 100-year storm as the SDF.

The peak SDF inflow rate is 597 c.f.s.for Cream Ridge Pond (See Appendix 4), as calculated in accordance with analytical procedures contained in Special Report 38 published by the NJDEP. Under the peak SDF flow conditions the maximum water level would be about elevation 95.8 and would yield negligible freeboard. If the pond level were equal to the crest of the dam, the principal spillway would be outlet controlled with a discharge rate of about 155 c.f.s. and the water level at the auxiliary spillway would be about 2.6 feet above the spillway crest and would discharge about 452 c.f.s. The combined spillway discharge with the water level at the dam crest would be approximately 607 c.f.s.

b. Experience Data

Based on discussions with the Farm Superintendent, the dam has not been overtopped and discharge through the auxiliary spillway has only occurred twice since the dam was completed in 1972.

c. Visual Observation

At the time of the field inspections there was no evidence of overtopping of the dam in the recent past. The auxiliary spillway was in good condition with the grass cut short.

d. Overtopping Potential

As noted in Paragraph 5.1a, the dam would not be overtopped during the SDF. It is clear from the current calculations in Appendix 4 that the dam would be overtopped by the SDF, if the auxiliary spillway were not available to accept substantial discharge.

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

At the time of the field inspections, there were no signs of distress or subsidence in the dam or spillways. Two seepage areas were noted indicating that seepage paths through the dam may exist. It was not possible at the time of the inspection to precisely determine the source or degree of development of the seepage paths. The severity of the observed seepage can only be evaluated by periodic observation and measurement, however, the presence of seepage areas does suggest a potentially serious condition.

For the most part, the riser pipe and the 36 inch diameter outlet pipe were either submerged or buried, however the limited exposed areas were in good condition with no signs of corrosion.

The portions of the anti-vortex device assembly above the water level, consisting of deck planks, stringers, and posts were sound. Hardware at the structural connections and trash rack bars were in good condition with no signs of damage or corrosion.

b. Design and Construction Data

The original design calculations did not include a structural analysis of the dam with respect to the slope stability, seepage and soil bearing capacity. Sketchy geotechnical data are presented on the construction drawings, however no borings or soil tests were indicated.

A structural analysis of the anti-vortex device assembly was in the NJDEP file. A brief review of the calculations indicated the structure to be adequate.

c. Operating Records

No records were available.

d. Post Construction Changes

Shortly before construction was completed, a headwall was constructed for the 15 inch diameter pipe and gate valve and the invert of the riser pipe was paved with concrete.

During the 6 years that Cream Ridge Dam has existed, the facilities have not been changed substantially from the originally constructed configuration.

e. Seismic Stability

Cream Ridge Dam is located in Seismic Zone 1 as defined in "Recommended Guidelines for Safety Inspection of Dams" which is a zone of very low seismic activity. Experience indicates that dams in Seismic Zone 1 will have adequate stability under seismic loading conditions if stable under static loading conditions. Cream Ridge Dam appears to be stable under static loading conditions, based on the field inspections performed.

SECTION 7: ASSESSMENT AND RECOMMENDATIONS

7.1 Dam Assessment

a. Safety

The SDF peak established for Cream Ridge Dam (100-year flood peak flow) has been calculated to be 597 cfs. The combined capacity of the spillways when the lake stage is at elevation 95.8 (top of dam) was calculated to be 607 cfs. Although the downstream outlet of the auxiliary channel will experience erosion, as a result substantial discharge the dam and spillways will accommodate the SDF without overtopping the dam and are adequate according to criteria set forth by the U.S. Army Corps of Engineers.

Seepage zones observed on the south side of the downstream embankment slope and on the adjacent natural embankment to the south of the dam are potentially hazardous. However, based on the field inspections performed for this study the dam appears to be structually stable.

The overall condition of the dam is good.

b. Adequacy of Information

Information sources included: 1) field investigations, 2) design calculations, construction plans, construction inspection reports and correspondence in NJDEP files, 3) USGS quadrangle sheets, 4) aerial photographs from Monmouth County, and 5) consultation with the Farm Superintendent, Rutgers, The State University. This information is sufficient for a Phase I Assessment as outlined in "Recommended Guidelines for Safety Inspection of Dams".

c. Necessity for Additional Data/Evaluation

Additional data are necessary to assess the dam relative to the seriousness and sources of seepage observed on the downstream slope of the embankment. These data should include: a comprehensive topographic survey; seepage observations and measurements, and investigation of the toe drain condition.

7.2 Recommendations

a. Remedial Measures

It is recommended that the following measures be undertaken by the owner in the near future:

1) The toe drain should be inspected and cleaned or reconstructed as may be necessary to insure proper operation.

2) The eroded area at the downstream end of the auxiliary spillway should be filled, compacted and stabilized with ground cover vegetation.

3) Remove riprap blockage at downstream end of the stilling basin at discharge culvert outlet. Install new riprap apron with properly sized stone to prevent future scour.

4) Trees and brush on the south end of the embankment should be cut off at the ground surface with minimal disturbance of the existing ground. The area should be stabilized with ground cover vegetation.

Implementation of the above recommendations will require detailed designs and NJDEP approval.

b. Maintenance

The owner should initiate a formal program of annual inspection and maintenance with special attention given to the toe drain to assure proper drainage of the embankment without seepage. These inspections should be performed by a qualified professional engineer and the observations and measurements should be recorded on standardized check-list forms. Inspection check-lists, complete records of maintenance and design calculations plus construction drawings for post construction changes should be included in a permanent file, available for public inspection. Annual maintenance should include: removal of brush and trees from the embankment; repair of the riprap apron at the discharge culvert outlet; repair of erosion at the downstream end of the auxiliary channel and repair and cleaning of the toe drain.

c. Additional Studies

A qualified professional engineer should be engaged soon to monitor the seepage on the downstream slope by visual observation and measurements on a monthly basis to determine the source and seriousness of the seepage. The present toe drain system should be investigated to determine its adequacy. A detailed topographic survey of the dam and surrounding areas should be performed by a qualified professional engineer or licensed land surveyor. The survey information, observations and mseaurements should be studied thoroughly and recorded on copies of the original construction drawings to provide a convenient reference and included in the permanent record.

PLATES

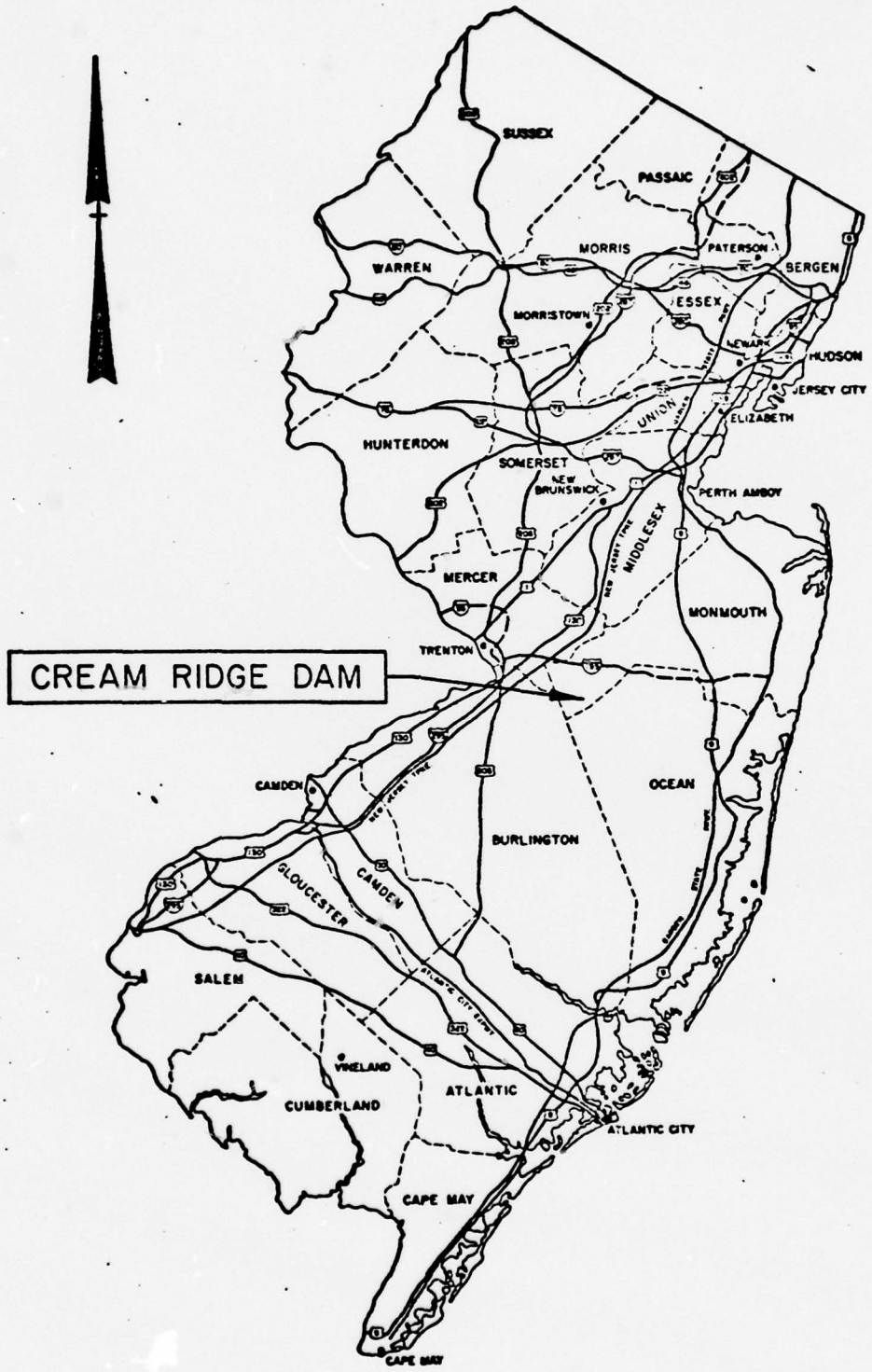


PLATE 1

STORCH ENGINEERS
FLORHAM PARK, NEW JERSEY

DIVISION OF WATER RESOURCES
N.J. DEPT. OF ENVIR. PROTECTION
TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

KEY MAP

CREAM RIDGE DAM

I.D. N.J. 00252

SCALE: NONE

DATE: FEBRUARY, 1979

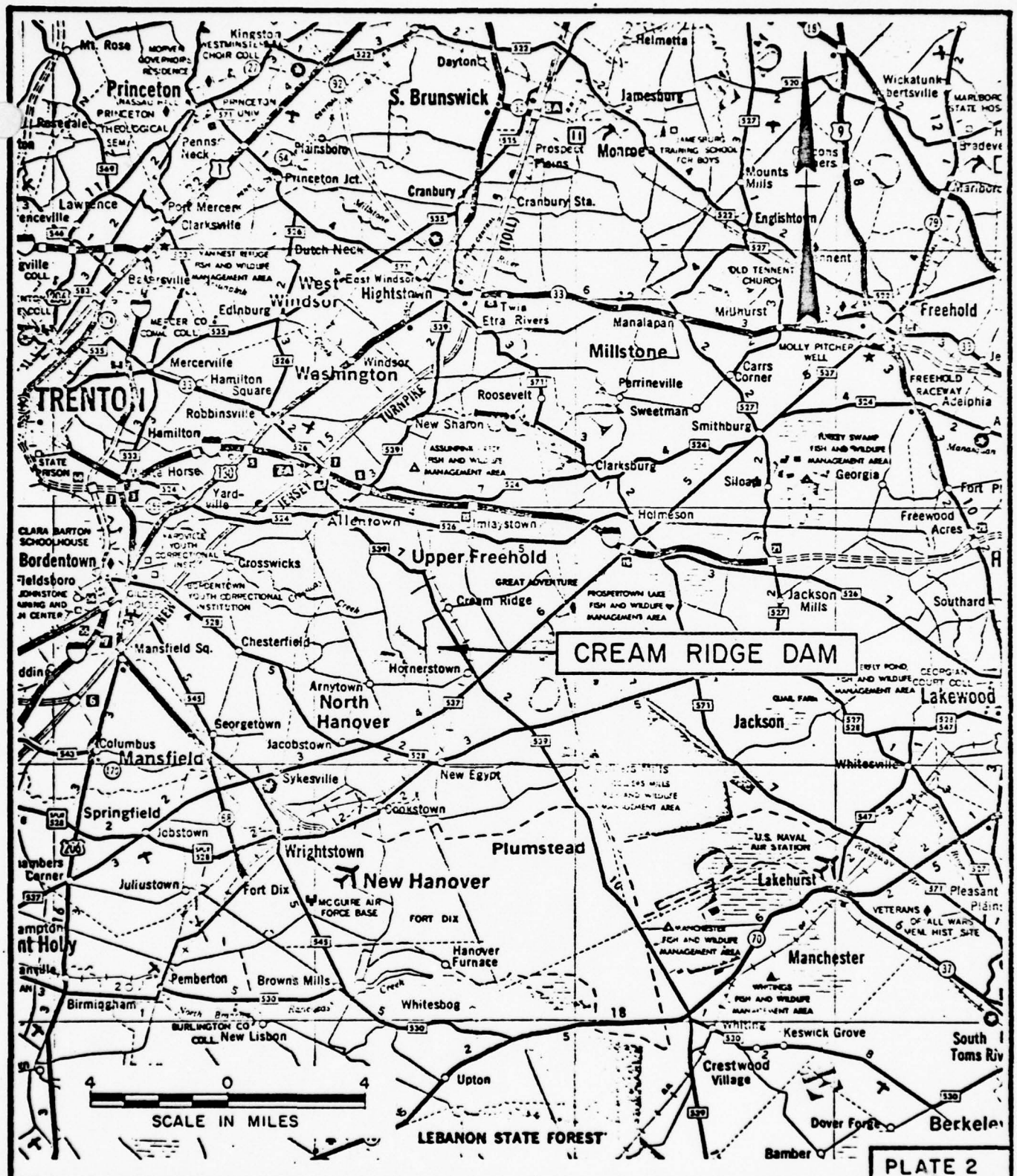


PLATE 2

STORCH ENGINEERS
FLORHAM PARK, NEW JERSEY

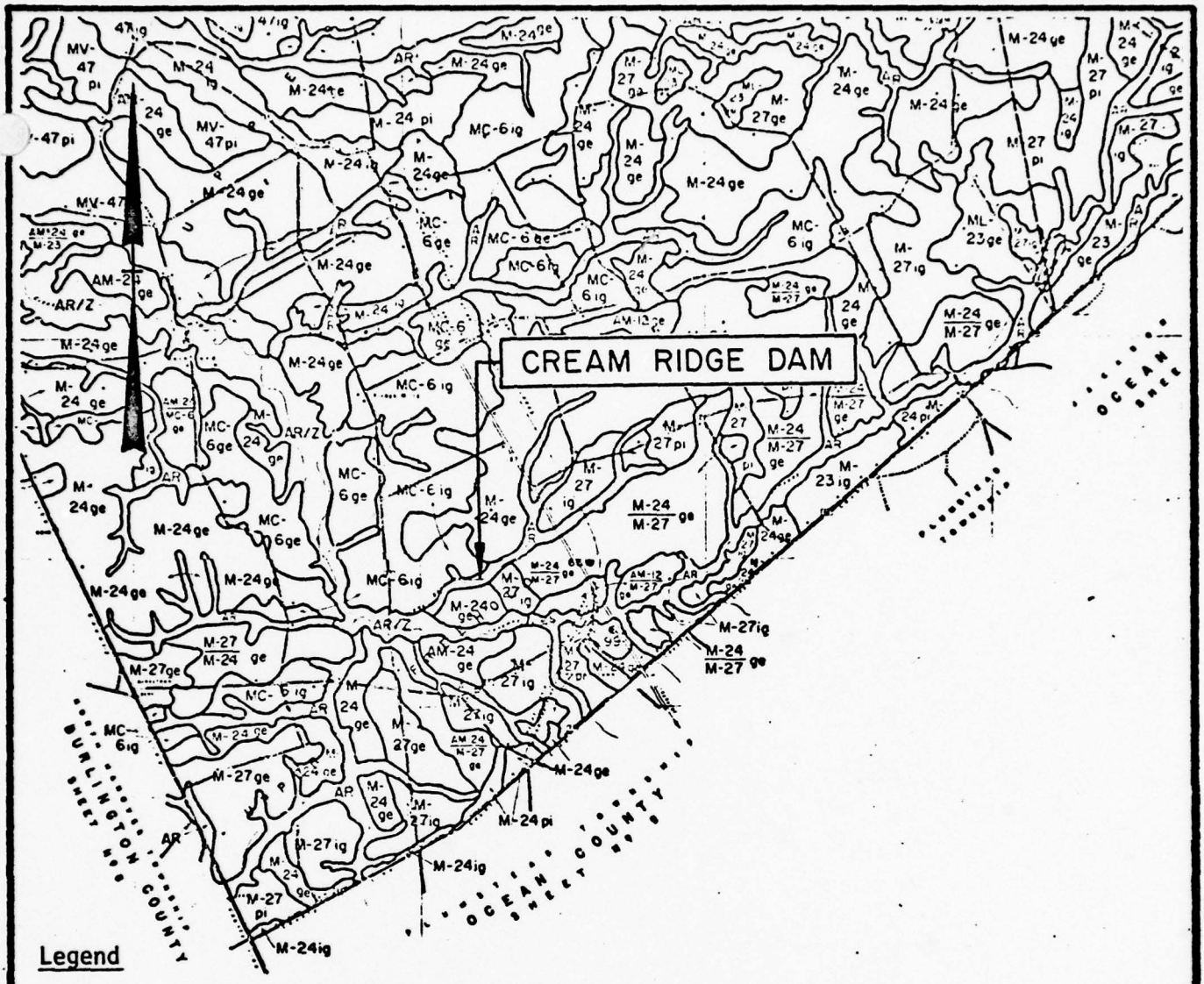
DIVISION OF WATER RESOURCES
N.J. DEPT. OF ENVIR. PROTECTION
TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

VICINITY MAP

CREAM RIDGE DAM

I.D. N.J. 00252	SCALE: AS SHOWN
	DATE: FEBRUARY, 1979



Legend

AR	Silt and sand, with some clay and a significant organic matter near the surface.
M-24	Silt, sandy silt, silty sand and very fine sand (Mount Laurel and Wenonah Sands).
M-27	Dense silt, clay and sand, cemented layers commonly present with depth (Hornerstown Marl).

Note

Information taken from Rutgers University Soil Survey of New Jersey, Report No. 19, Monmouth County and Geologic Map of New Jersey prepared by Lewis and Kummel.

PLATE 3

STORCH ENGINEERS
FLORHAM PARK, NEW JERSEY

DIVISION OF WATER RESOURCES
N.J. DEPT. OF ENVIR. PROTECTION
TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

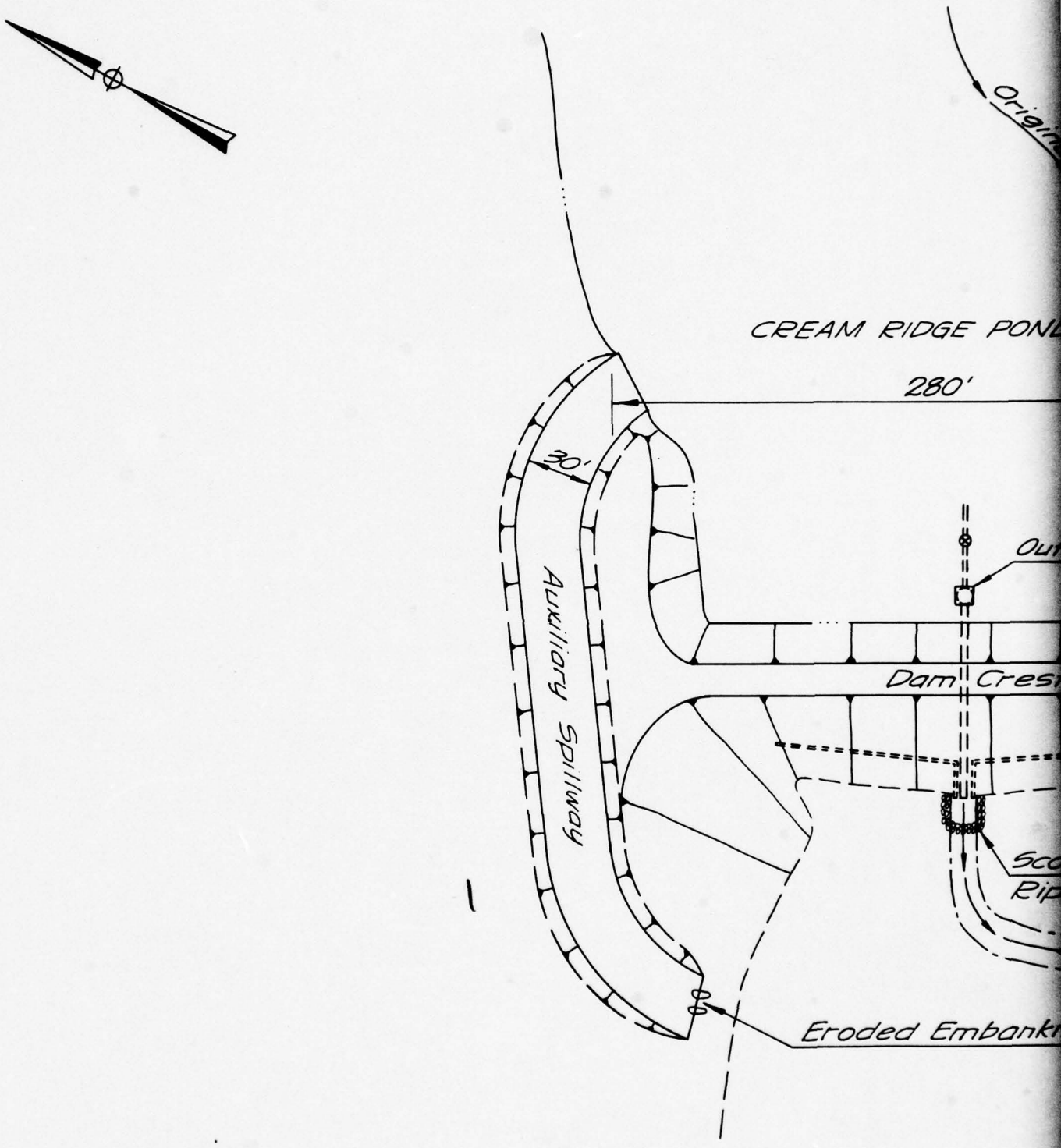
SOIL MAP

CREAM RIDGE DAM

I.D. N.J. 00252

SCALE: NONE

DATE: FEBRUARY, 1979



NOTE:
Information taken from "Plan of Dam & Pool Area" by USDA, Soil Conservation Service and field inspection December 7, 1978.

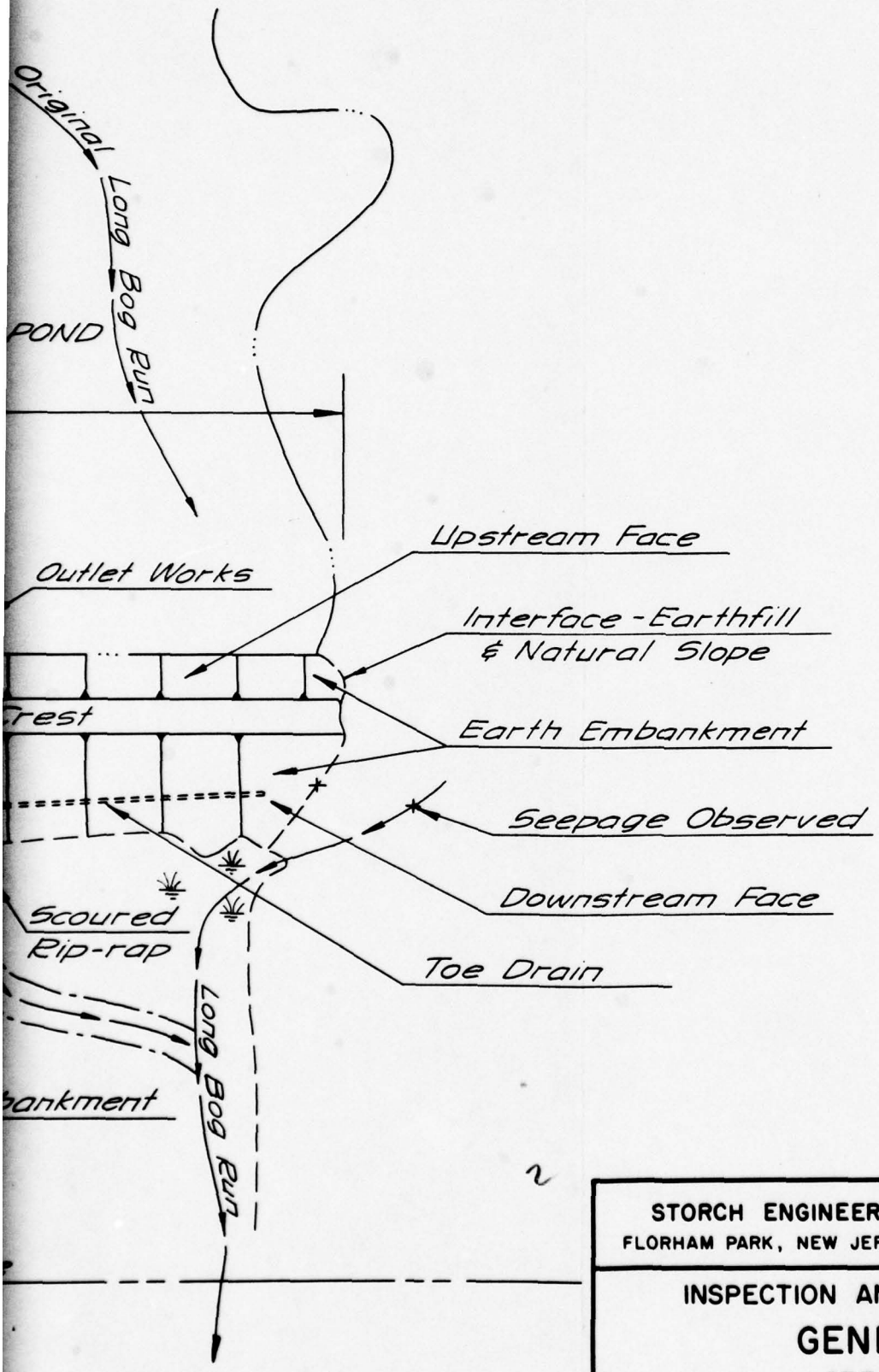


PLATE 4

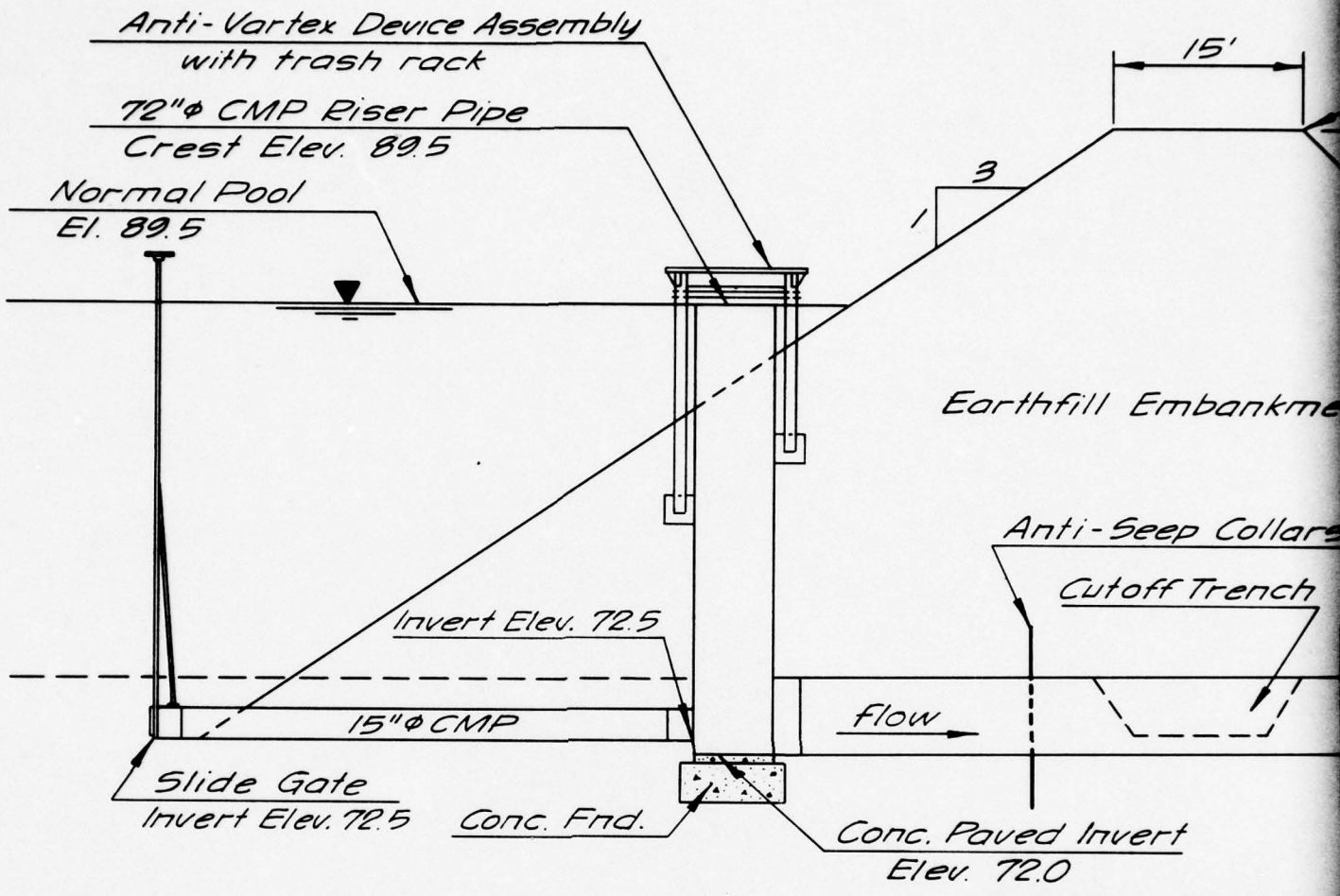
STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

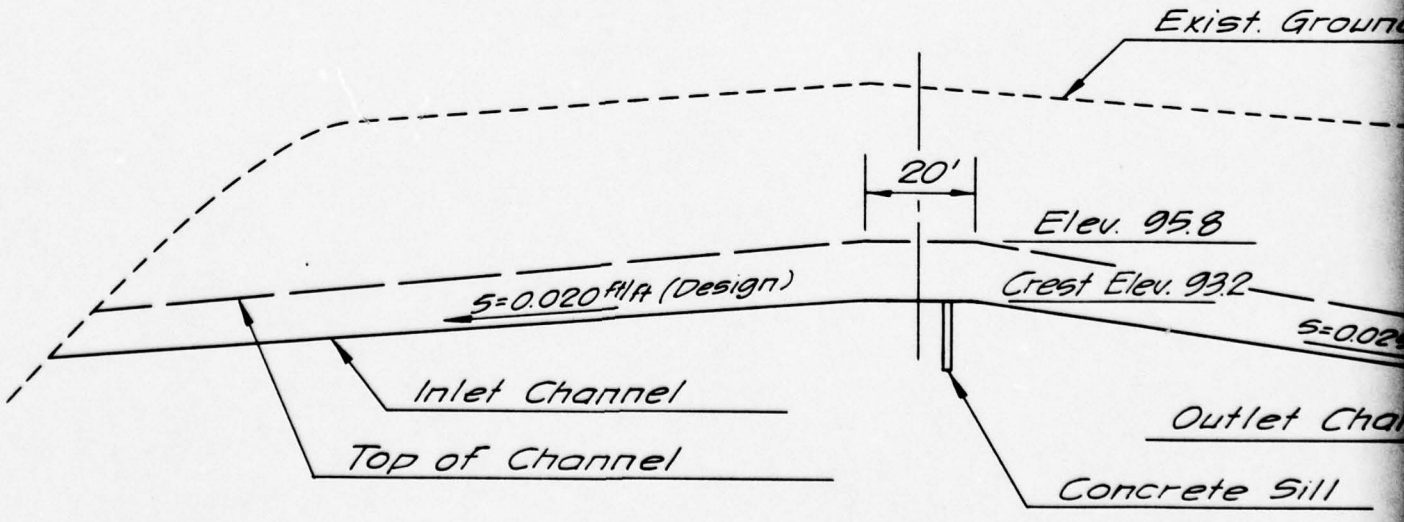
GENERAL PLAN

CREAM RIDGE DAM

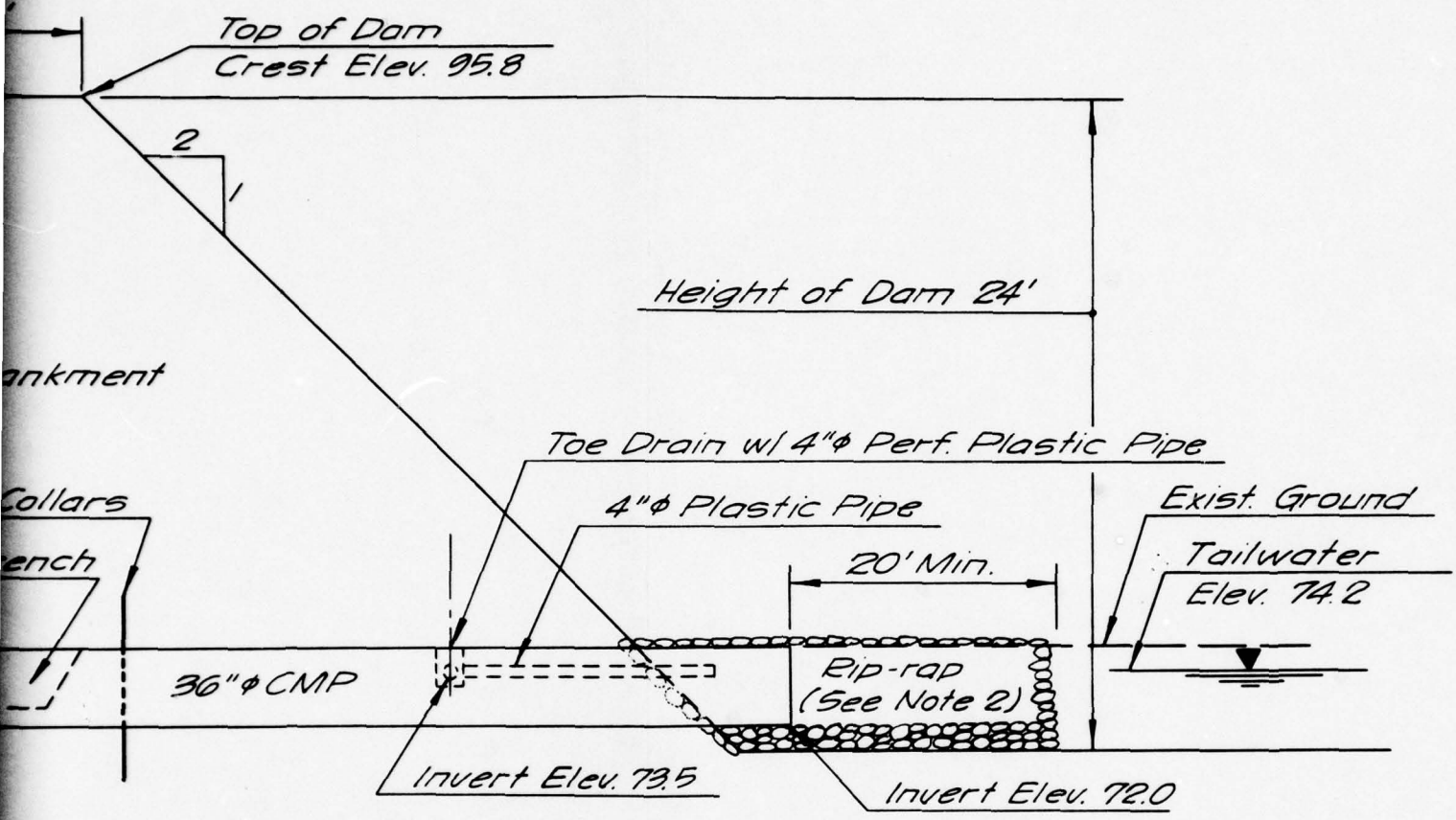
I.D. N.J. 00252	SCALE: NOT TO SCALE
	DATE: FEBRUARY, 1979



SECTION - PRINCIP



SECTION - AUXILIARY SPILLWAY



RINCIPAL SPILLWAY

NOTES:

1. Information taken from "Cross Section of Dam & Spillway" by USDA, Soil Conservation Service and field inspection December 7, 1978.
2. Field inspection indicated that the Rip-rap was scoured.

Ground

S=0.029 Ft/Ft. (Field Measurement)

t Channel

Sill

PLATE 5

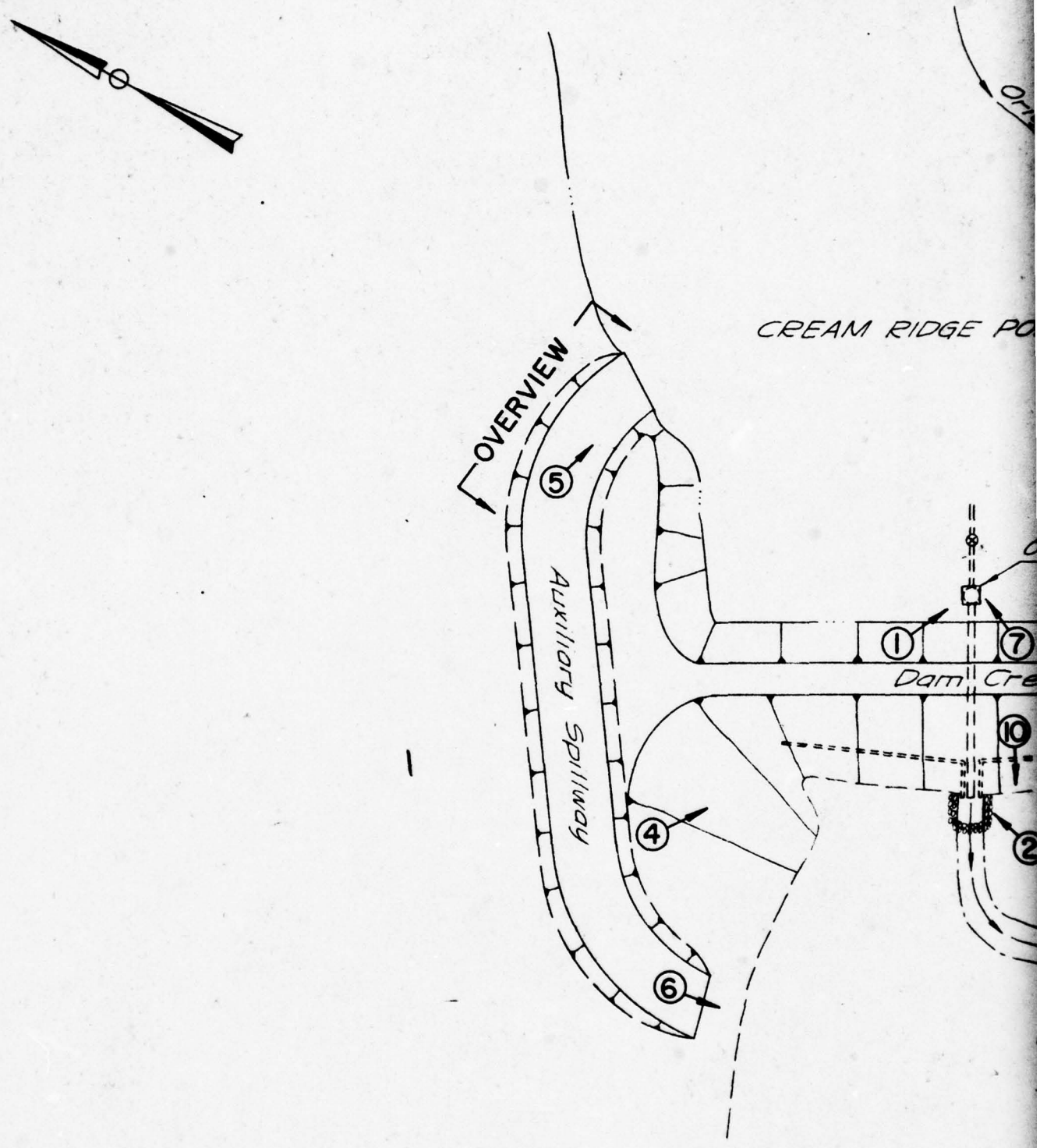
STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

SPILLWAY SECTIONS

CREAM RIDGE DAM

I.D. N.J. 00252	SCALE: NOT TO SCALE
	DATE: FEBRUARY, 1979



NOTE:
Information taken from "Plan of Dam & Pool Area" by USDA, Soil Conservation Service and field inspection December 7, 1978.

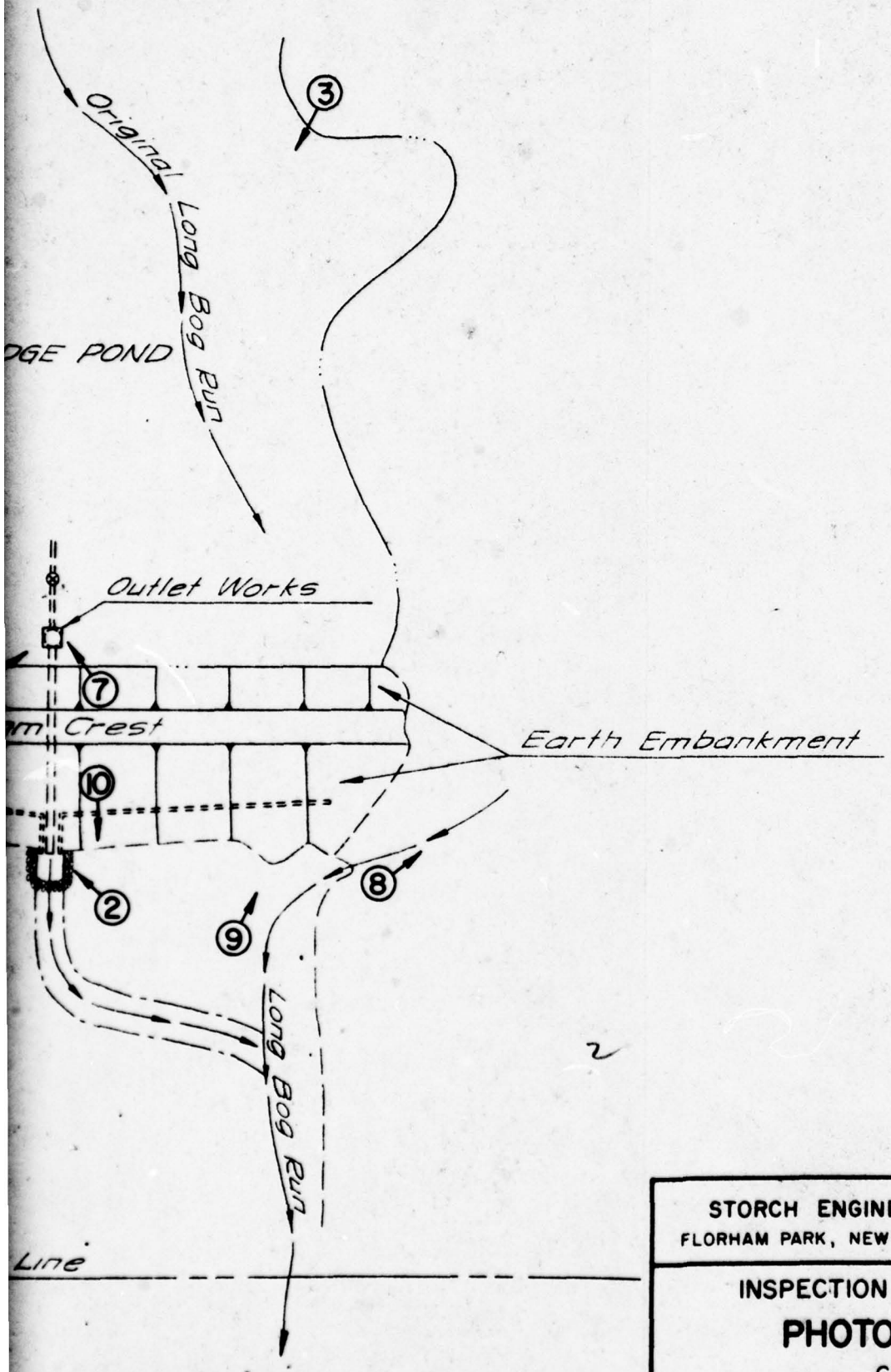


PLATE 6

STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

PHOTO LOCATION PLAN

CREAM RIDGE DAM

I.D. N.J. 00252	SCALE: NOT TO SCALE
	DATE: FEBRUARY, 1979

APPENDIX 1

Check List - Visual Inspection

Check List - Engineering Data

Check List
Visual Inspection
Phase 1

Name Dam Cream Ridge **County** Monmouth **State** N. J. **Coordinators** NJDEP

Date(s) Inspection 12/07/78 02/02/79 **Weather** Clear **Temperature** 30°F

Pool Elevation at Time of Inspection +88' M.S.L. **Tailwater at Time of Inspection** +71.6' M.S.L.

Inspection Personnel:

Richard McDermott
Miron Petrovski
John Gribbin
John Gribbin
E. A. Wiltsie
Dinesh Patel

E. A. Wiltsie **Recorder**

Owner Representative:
None

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SEE PAGE ON LEAKAGE	N/A	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	N/A	
DRAINS	N/A	
WATER PASSAGES .	N/A	
FOUNDATION	N/A	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBERSVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	N/A	
STRUCTURAL CRACKING	N/A	
VERTICAL AND HORIZONTAL ALIGNMENT	N/A	
MONOLITH JOINTS	N/A	
CONSTRUCTION JOINTS	N/A	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	NONE	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	NONE	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Eroded gullies at downstream end of auxiliary spillway.	Regrade to reduce slope at downstrea outlet, compact, mulch and seed.
VERTICAL AND HORIZONTAL ALINEMENT OF THE CREST	Good, no signs of movement.	
RIPRAP FAILURES	Riprap apron downstream of 36" CMP outlet scoured, leaving a small basin encircled with riprap and a pervious riprap dam at downstream end.	Reconstruct apron to grades and dime on original construction plans with larger stone.

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
GENERAL		
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	South junction of earthfill with natural embankment is suspected as source of seepage observed at toe of downstream slope of dam.	Observe Seepage zone and measure flow rates.
ANY NOTICEABLE SEEPAGE	Soft wet area at toe of downstream slope on dam. Flow observed in natural eroded drainage gully south of dam and about 75 feet west. Seepage water temp. = 10.3° C	Observe flow to establish sources.
STAFF GAGE AND RECORDER	NONE	
DRAINS	No drains observed.	Toe trench should be checked and outlet pipes cleared.

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	N/A	
INTAKE STRUCTURE	15 inch diameter pipe connecting to the 72 inch diameter riser at invert. Submerged & could not be observed.	
OUTLET STRUCTURE	36 inch diameter CMP, good condition. Flow approximately 2' deep. Riprap apron scoured.	Reconstruct apron with larger stone.
OUTLET CHANNEL	N/A	
EMERGENCY GATE	NONE	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
WEIR	Principal Spillway Circular 72 inch diameter CMP, galvanized, good condition.	
APPROACH CHANNEL	Auxiliary Spillway Trapazoidal cross-section 30 feet wide, grass lined. Slopes up to concrete sill at crest (elev. +93.2) at 0.02 ft/ft (design). Good condition.	
DISCHARGE CHANNEL	Auxiliary Spillway Trapazoidal cross-section, 30 feet wide, grass lined. Slope down at 0.029 ft/ft (field measurement). Good condition with some eroded gullies at downstream end.	Regrade, compact, mulch & seed downstream end of channel.
BRIDGE AND PIERS	N/A	

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	N/A	
APPROACH CHANNEL	N/A	
DISCHARGE CHANNEL	N/A	
BRIDGE AND PIERS	N/A	
GATES AND OPERATION EQUIPMENT	N/A	

INSTRUMENTATION

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	NONE	
OBSERVATION WELLS	NONE	
WEIRS	NONE	
PIEZOMETERS	NONE	
OTHER	NONE	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Side slopes range from 2% to 15% ℄ slopes range from 1% to 3% stable with dense trees and brush immediately adjacent to shoreline.	
SEDIMENTATION	Not observed	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Low pervious dam of scoured riprap about 20 feet from outlet pipe. Natural stream clear with no obstruction, sand bottom & steep sideslopes to broad flat flood plain with moderate vegitation.	
SLOPES	Natural stream slope is slight immediately downstream of dam. Surrounding flood plain is almost flat & brodered by steep embankments at outer limits.	
APPROXIMATE NO. OF HOMES AND POPULATION	None in the vicinity of the dam. Agricultural area.	

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	Construction plans for dam and spillways (Principal and Auxiliary) by Soil Conservation Service, dated 1970. Available from NJDEP file.
REGIONAL VICINITY MAP	Available
CONSTRUCTION HISTORY	Construction inspection reports on monthly basis by NJDEP indicate construction satisfactory and in accordance with Plans. Correspondence indicates addition of concrete headwall at the slide gate inlet and concrete paved invert in the riser pipe. Reports and correspondence available from NJDEP file.
TYPICAL SECTIONS OF DAM	Contained in Plans by the Soil Conservation Service. Available from NJDEP file.
HYDROLOGIC/HYDRAULIC DATA	Hydraulic analysis by the Soil Conservation Service. Available from NJDEP file
OUTLETS - PLAN	Available from Plans by the Soil Conservation Service in NJDEP file.
- DETAILS	
-CONSTRAINTS -DISCHARGE RATINGS	Not Available
RAINFALL/RESERVOIR RECORDS	Not Available

ITEM	REMARKS
DESIGN REPORTS	Not Available
GEOLOGY REPORTS	Not Available
DESIGN COMPUTATIONS	Available from NJDEP file. Prepared by Soil Conservation Service.
HYDROLOGY & HYDRAULICS	Available from NJDEP file. Prepared by Soil Conservation Service.
DAM STABILITY	Not Available
SEEPAGE STUDIES	Not Available
MATERIALS INVESTIGATIONS	General Descriptions available from Plans by Soil Conservation Service.
BORING RECORDS	Not Available
LABORATORY	Not Available
FIELD	
POST-CONSTRUCTION SURVEYS OF DAM	Not Available
BORROW SOURCES	Shown on Plans by Soil Conservation Service. (Auxiliary Spillway area was borrow source). Available from NJDEP file.

ITEM	REMARKS
MONITORING SYSTEMS	None
MODIFICATIONS	Headwall at gate valve and paved invert in riser pipe added during construction.
HIGH POOL RECORDS	Not Available
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	One Annual Condition Report dated Aug. 1972 in NJDEP file.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None
MAINTENANCE OPERATION RECORDS	Soil treatment & Reseeding in 1972 Annual Condition Report in NJDEP file.

ITEM	REMARKS
SPILLWAY PLAN	
SECTIONS	Available from Plans by Soil Conservation Service in NJDEP file.
DETAILS	
OPERATING EQUIPMENT PLANS & DETAILS	Available from Plans by Soil Conservation Service in NJDEP file.

APPENDIX 2

Photographs

PHOTO 1

SPILLWAY

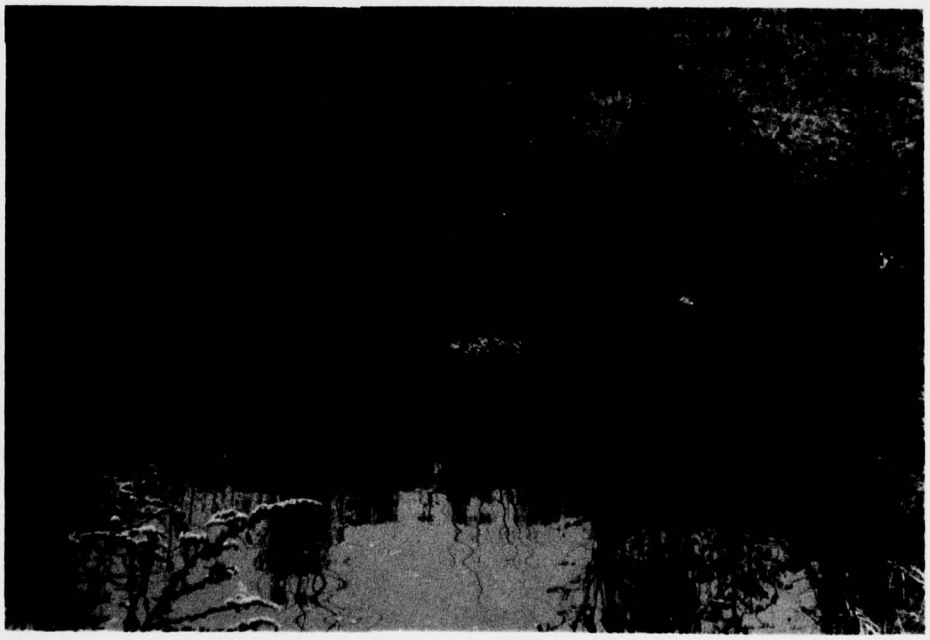


PHOTO 2

SPILLWAY DISCHARGE PIPE

7 DEC. 1978

PHOTO 3

EMBANKMENT - UPSTREAM FACE

PHOTO 4

EMBANKMENT - DOWNSTREAM FACE

7 DEC. 1978

PHOTO 5

AUXILIARY SPILLWAY INLET AT LAKE

PHOTO 6

EROSION AT AUXILIARY SPILLWAY OUTLET

7 DEC. 1978

PHOTO 7

GATE OPERATING SHAFT WITH SPILLWAY
IN FOREGROUND

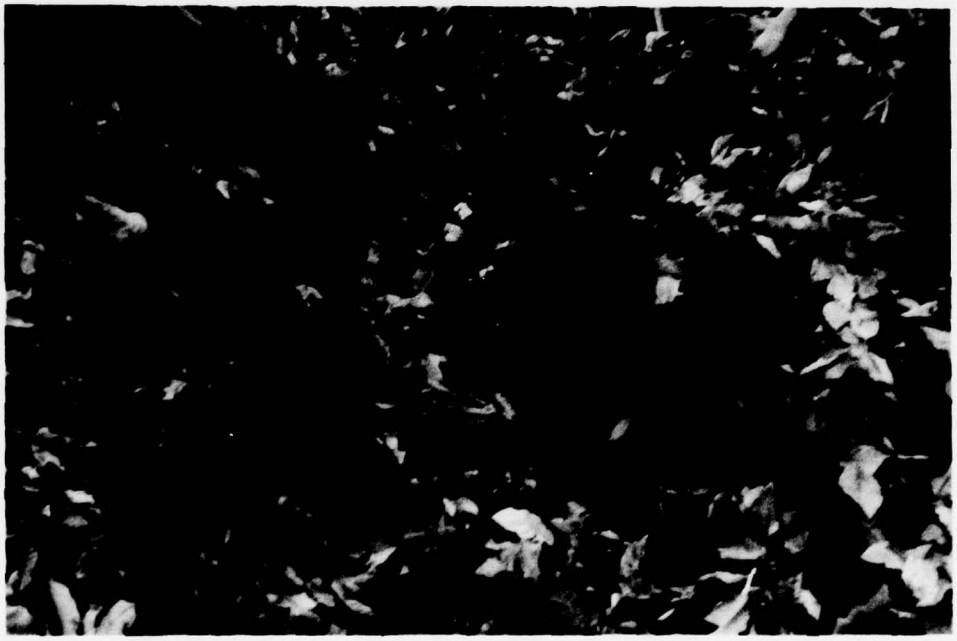


PHOTO 8

SUSPECTED SEEPAGE ON SLOPE AT
SOUTH END OF DAM

7 DEC. 1978

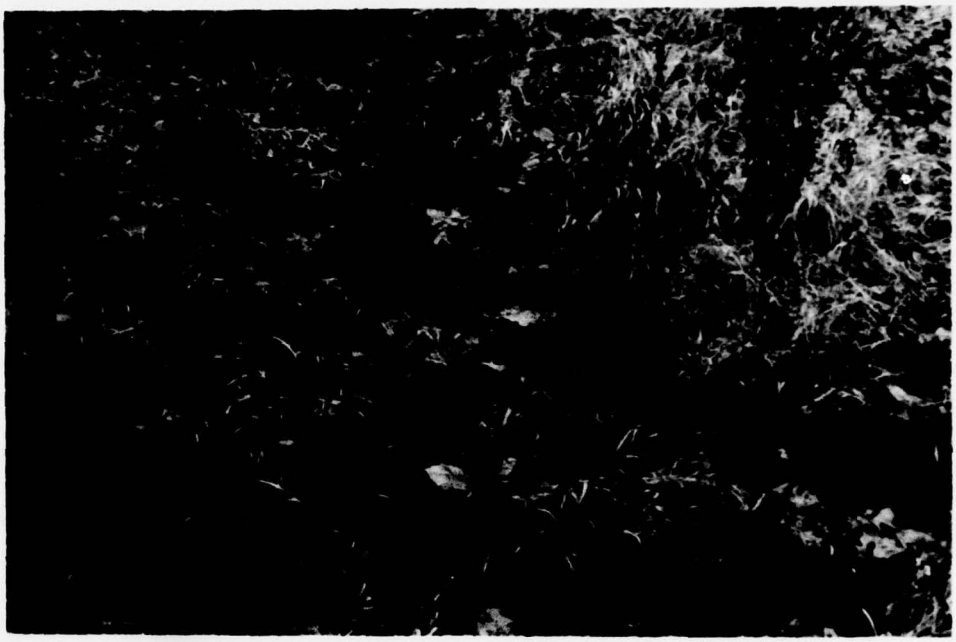


PHOTO 9

SEEPAGE AT TOE OF DAM

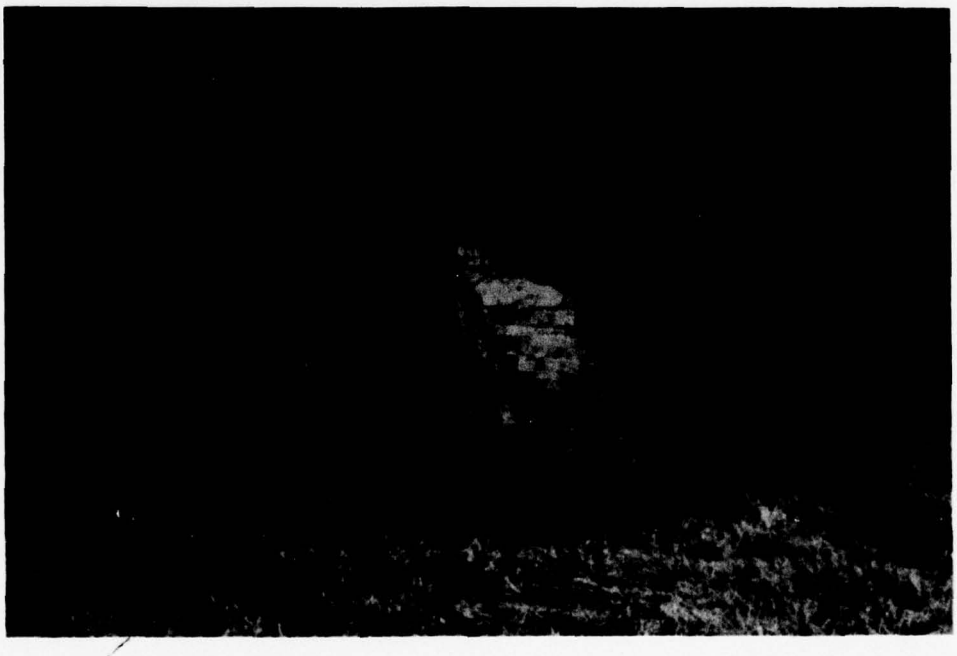


PHOTO 10

DOWNSTREAM CHANNEL

7 DEC. 1978

APPENDIX 3

Engineering Data

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: Agricultural and Natural Wooded

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 89.5 (MSL) (85 acre-feet)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): N.A.

ELEVATION MAXIMUM DESIGN POOL: 95.8

ELEVATION TOP DAM: 95.8

SPILLWAY CREST:	Principal Spillway	Auxiliary Spillway
a. Elevation	89.5	93.2
b. Type	Uncontrolled 72" diameter Corrugated Metal Pipe	Uncontrolled grassed trapezoidal channel.
c. Width	-	20 ft. at concrete sill.
d. Length	18 ft	30 ft. (bottom)
e. Location Spillover	Into 72" diameter riser	Along natural downstream channel bank.
f. Number and Type of Gates	None	None

OUTLET WORKS: 15" dia. CMP inlet w/headwall & gate valve, 36" dia. outlet.

a. Type Corrugated Metal Pipe

b. Location 15" dia. pipe extends about 45 ft. upstream from riser pipe. 36" dia. pipe extends about 70 ft. downstream from riser pipe

c. Entrance inverts 72.5

d. Exit inverts 72.0

e. Emergency draindown facilities: Free standing manual slide gate at headwall.

HYDROMETEOROLOGICAL GAGES: None

a. Type N.A.

b. Location N.A.

c. Records N.A.

MAXIMUM NON-DAMAGING DISCHARGE:

(Lake stage equal to top of dam) 607 cfs

SCS COMPUTATIONS

(1970)

Dam Application No 610

Cranbridge Dam on Long Bog Run, tributary of Crosswicks Creek.

Pool Normal Elevation 89.5
Design High Water Elevation 94.8
Auxiliary Spillway
- crest elevation 93.2
Dam crest Elevation 95.8

Q_{50} = 580 cfs

Hydraulic:

weir flow:

$Q = C L H^{3/2}$

C = 3.1

L = 6' dia L. $3.14 \times 6 =$ 18.84'

$Q = 3.1 \times 18.84 \times (5.3)^{3/2}$

$= 58.5 \times 12.2$

= 715 cfs > 580

PIPE FLOW PIPE DIA 36"
CMP

FLOW AT ELEVATION 94.8 IS EQUAL TO 110 cfs

AUX. SPILLWAY FLOW:

CREST ELEVATION 93.2

HEAD AT ELEVATION 94.8 IS EQUAL TO 1.6 ft.

BOTTOM WIDTH 30'

SLOPES 3:1

$A = 30 \times 1.6 + 7.68$

$= 48 + 7.68$

$= 55.8 \text{ ft}^2$

$T = 30 + 9.6$

$= 39.6 \text{ ft}$

$$\frac{Q_c^2}{g} = \frac{A^3}{T} = 32.2 \times \frac{(55.8)^3}{39.6}$$

$$= \frac{(55.8)^3}{1.23} = (55.8)^2 \times \frac{55.8}{1.23}$$

$$Q_c = 55.8 \times \sqrt{\frac{55.8}{1.23}}$$

$= 55.8 \times \sqrt{45.4}$

$= 55.8 \times 6.7$

$= 450 \text{ cfs}$

AUX. SPILLWAY FLOW	450	cfs
PRINCIPAL SPILLWAY FLOW	110	cfs
TOTAL FLOW	560	cfs.

DAM APPLICATION 610

CREAM RIDGE DAM

DAM AWASH

AUX. SPILLWAY

$A = 30 \times 2.6 + 3 \times (2.6)^2$

$= 78 + 20.3$

$= 98.3\ ft^2$

$T = 30 + 15.6$

$= 45.6\ ft$

$Q_c^2 = g \times \frac{A^3}{T} = 32.2 \times \frac{(98.3)^3}{45.6}$

$= (98.3)^2 \times 98.3 \times \frac{32.2}{45.6}$

$= (98.3)^2 \times 98.3 \times \frac{1}{1.42}$

$Q_c = 98.3 \times \sqrt{\frac{98.3}{1.42}}$

$= 98.3 \times \sqrt{69}$

$= 98.3 \times 8.3$

$= \underline{\underline{81.5 cfs}}$

N.J.

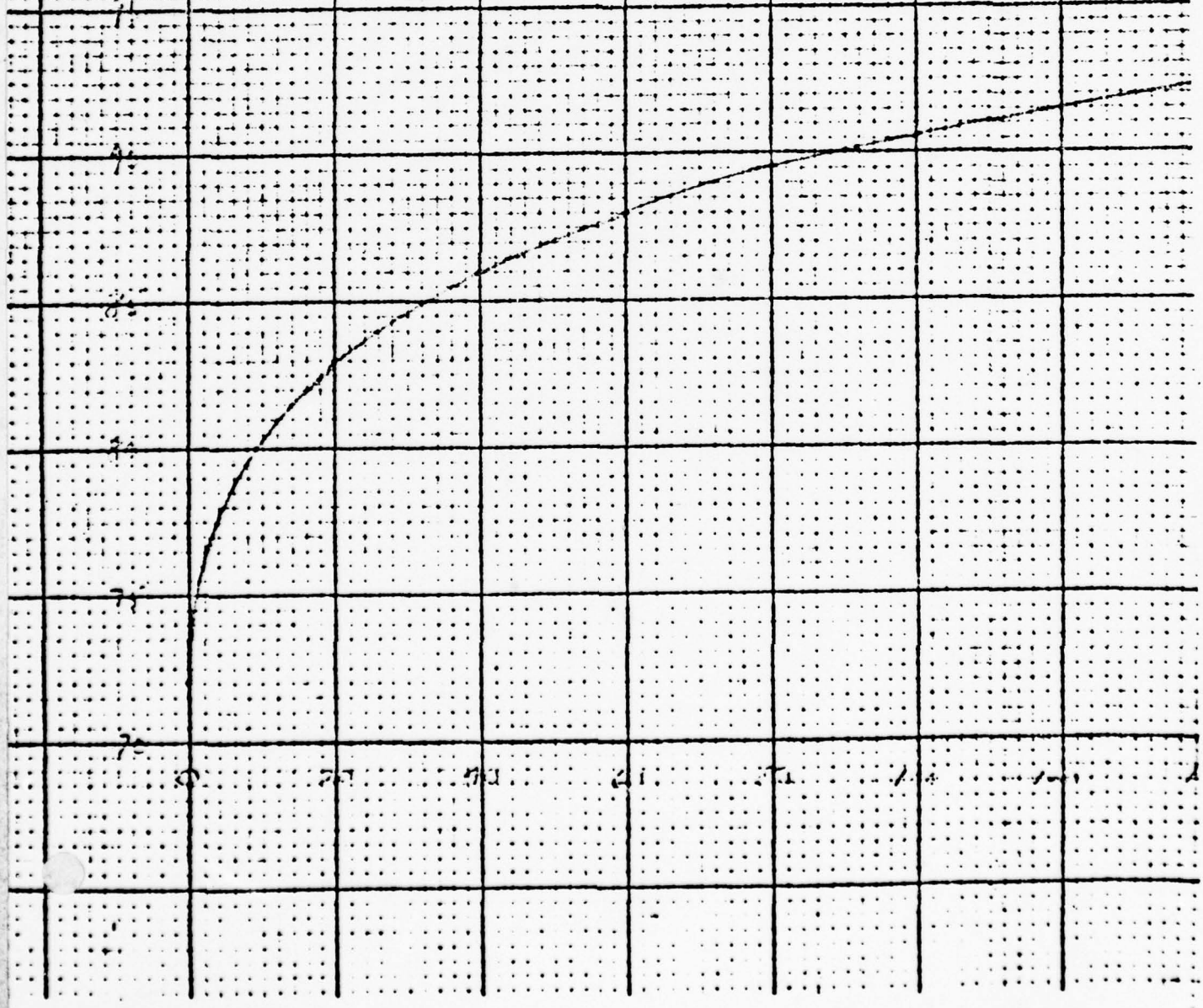
Stage - Storage Retention [illegible] "A"

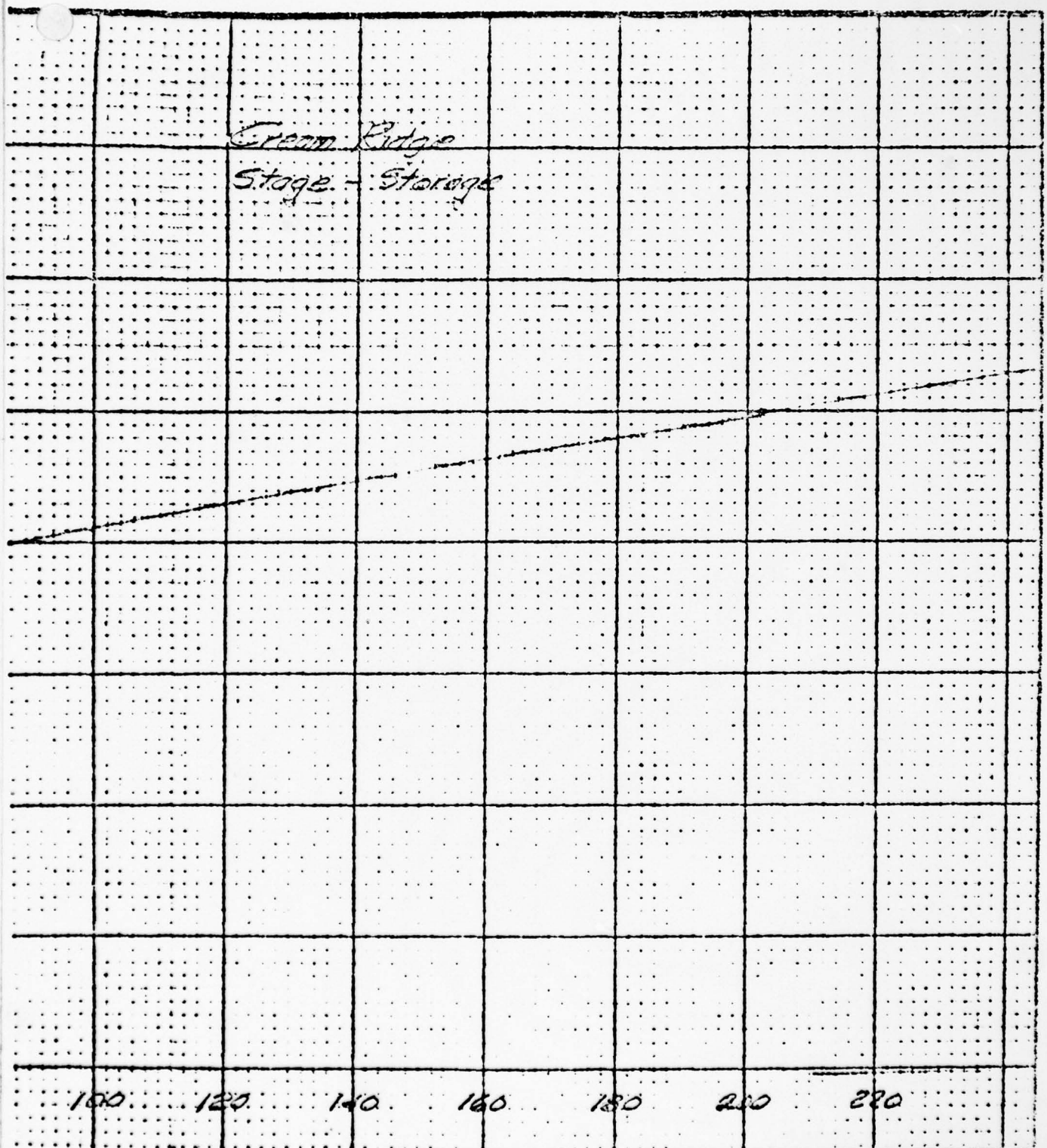
ELEV	AREA Sq. IN.	AREA Sq Ft.	AREA Ac.	AVG. DEPTH Ft	STORAGE Ac. Ft.	ACCUM. Ac. Ft.
72	0.0	0.0	0.0			
75	1.11	11,100	0.255	1.5	0.395	0.4
80	8.95	89,500	2.05	2.5	5.1	5.5
85	11.80	118,000	2.72	2.5	6.8	12.3
90	13.35	133,500	3.07	2.5	7.7	20.0

Combined Stage-Storage

Elev	Accum Storage (acre feet)
72	0
75	0.4
80	5.9
85	21.6
90	51.0

Elev	Storage ac-ft
89.0	72.0
89.5	90.0
90.0	90.0
90.5	100.0
91.0	110.0
92.0	130.0
93.0	156.0
94.0	180.0
95.0	202.0





U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

DESIGNED BY	APPROVED BY
CHECKED BY	DRAWING NO NJ-01-691

SCS-344 5-57
Tabular Computations

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Discharge Curve Table NJ-01-611

Weir Flow: $Q = CLH^{3/2}$

Cream Ridge

C = 3.1

CK JLA 7/

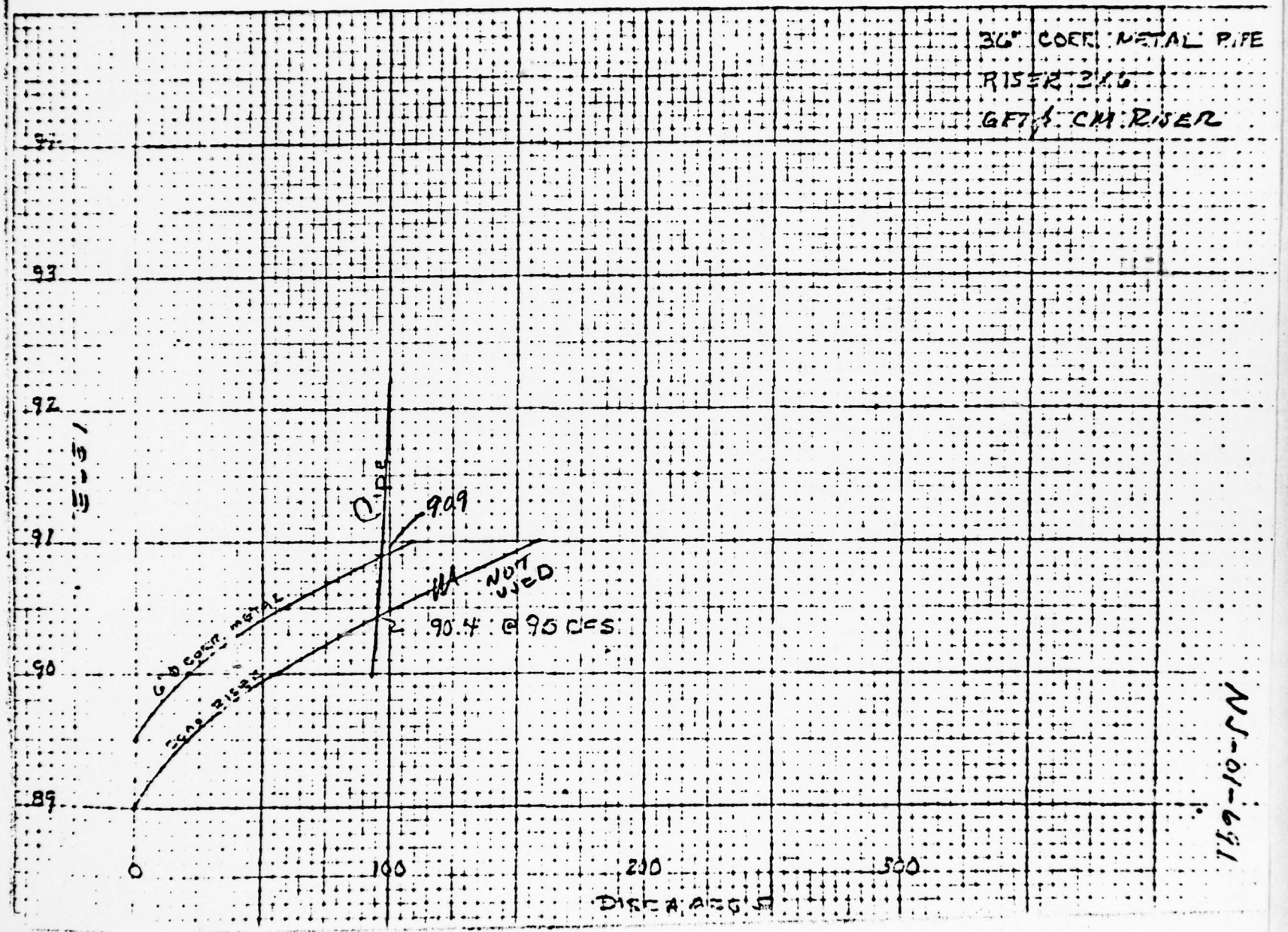
Elev.	H	$H^{3/2}$	Q_1 3x6 L=18	Q_2 3.5x6 L=19	Q_3 4x6 L=20	Q_4 4.5x6 L=21		
89	0	0	0	0	0	0		
89.5	.5	.3536	20	21	22	23		
90	1.0	1	56	59	62	65		
90.5	1.5	1.837	103	108	114	119		
91	2.0	2.828	158	167	175	184		
91.5	2.5	3.953	221	233	245	257		
92	3.0	5.196	290	306	322	338		
93	4.0	8	446	471	496	521		
94	5.0	11.19	624	659	693	728		

Weir Flow From 6' ϕ Corr Metal Riser

Subtract 8" From Weir Length For Braces:

L = 18.18 Ft. C = 3.22 CL = 58.54

89.5	0	0	0					
90	0.5	.3536	21					
90 5	1.0	1	59					
91.	1.5	1.837	108					
91.5	2.0	2 828	166					
92	2.5	3 553	231					
92.5	3.0	5.196	304					
94.5	5.0	11.18	654					



NJ-01-691

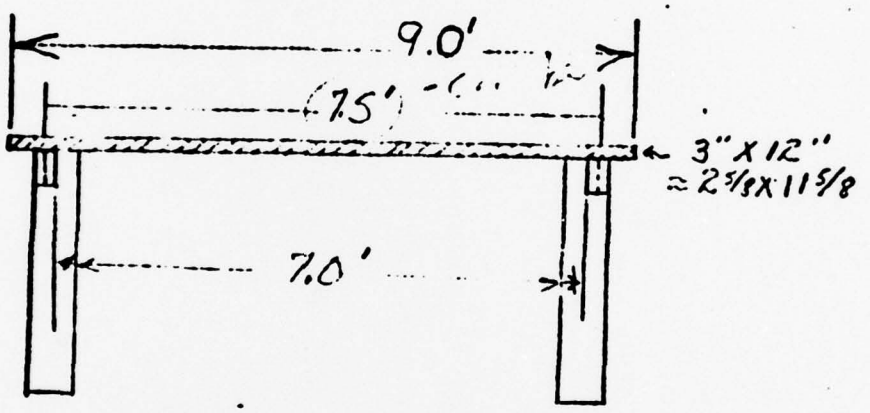
COMPUTATION SHEET
SCS-523 REV 5-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STATE NEW JERSEY | PROJECT [illegible] | JOB NO. N.J. 01-591
BY H MACK DATE 6-26-71 | CHECKED BY [illegible] DATE [illegible] | SHEET 1 OF 1
SUBJECT ANTI VORTEX DECK

A DECK IS 9'X9' AND SITS ON A 8"X8" POST THAT ARE SPACED 7' ON CENTER.

DESIGN THE DECK SO THAT IT WILL SUPPORT A 50 LBS PER FOOT LIVE LOAD AND A 5.0 LBS PER FOOT DEAD LOAD.



DETERMINE THE FLEXUAL STRESS

$M = \frac{WL^2}{8}$

$M = \frac{55\#/' (7.5')^2}{8}$

$M = \frac{(55\#/')(56.25)}{8}$

$M = 386.65$ FT-LBS

$S = \frac{MY}{I}$

$S = \frac{(386.65)(12)(9.5")}{17.4}$

$F = 354.65$ PSI

$I = \frac{Bd^3}{12}$

$I = \frac{(11.62)(2.62)}{12}$

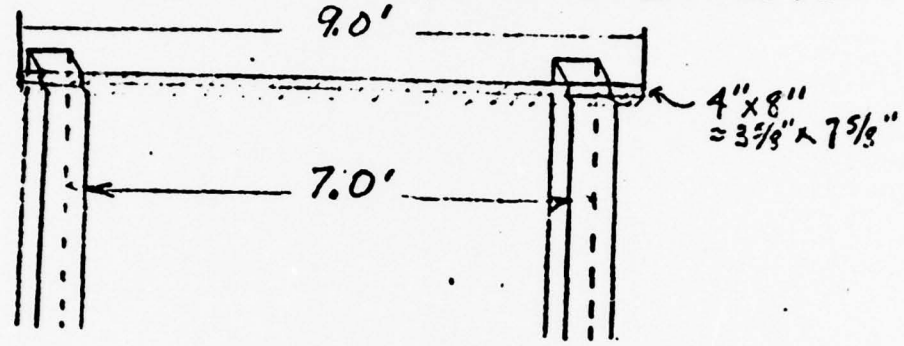
$I = 17.4$ in^4

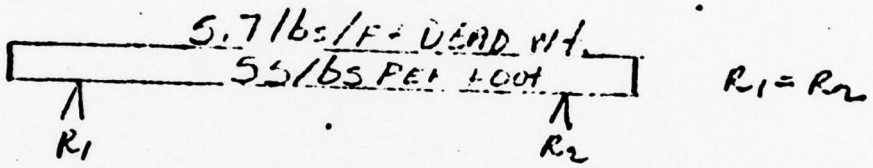
COMPUTATION SHEET
SCS-523 REV 5-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STATE NEW JERSEY | PROJECT | JOB NO. NJ-671
BY | DATE | CHECKED BY | DATE
SUBJECT AVI VORTEX DECK | SHEET 2 OF 1

DETERMINE THE REACTIONS AND THE FLEXURAL STRESS AT ITS WORKE CONDITIONS. DEAD WT 5.7 LBS PER FOOT.





$R_1 = R_2$

$R_1 = \frac{9 \times 55 + 5.7}{2}$

$R_1 = \frac{495 + 5.7}{2}$

$R_1 = 500.7 / 2$

$R_1 = 250.35$

258.1

$\sigma = \frac{MY}{I}$

1550.9

$\sigma = \frac{(1533.4)(12)(3.81)}{133.4}$

$\sigma = 025.54$ psi

531.6

$I = \frac{bd^3}{12}$

$I = \frac{(3.62)}{12}$

$I = 133.9$

$M = \frac{WL^2}{8}$

258.1

$M = \frac{250.35 (7)^2}{8}$

$M = 1533.4$ Ft-lbs

1550.185

New Jersey — Cream Ridge
C. Montana 6-70 — 8/20/70

CONDUIT DESIGN : PRINCIPAL SPILLWAY

TOP OF DAM CONST. ELEV :	96.30	FT.
INVERT OF PIPE :	72.00	FT.
HEIGHT OF FILL :	24.30	FT.
DIA OF PIPE :	36	IN.

Right

FROM TABLE 9-2 Pg 107 GAGE # 12

DUE TO LONG REQUIRED LIFE AND MINOR INCREASE IN COST IT IS FELT ADVISABLE TO GO TO 10 GAGE --

USE 10 GAGE

CONDUIT DESIGN : POND DRAIN

HEIGHT OF FILL	:	9 FT.
DIA. OF PIPE	:	15 IN.
MINIMUM REQD GAGE	:	16

USE 14 GAGE

New Jersey Cream Ridge

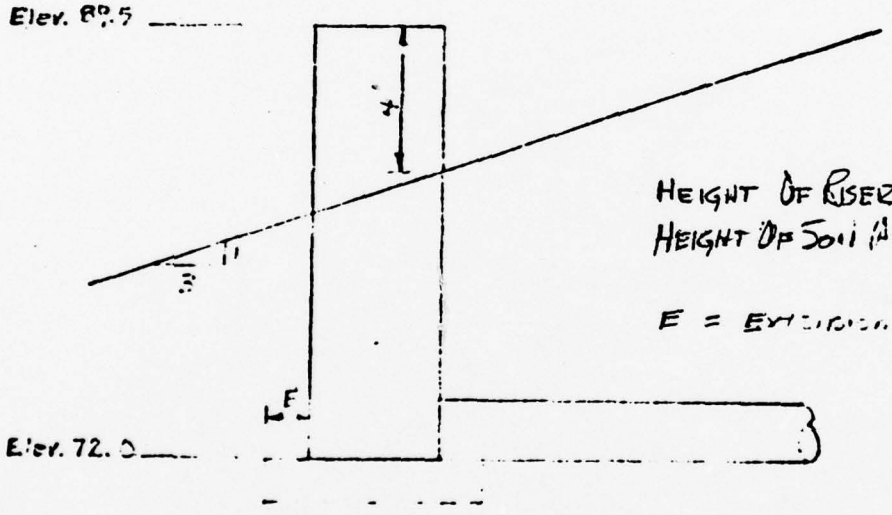
C Montana [illegible] 6-16-70 [illegible]

CHECK ON RISER BUOYANCY

72 INCH CMP 10 gage	:	150 #/Ft
36 INCH CMP, 10 gage	:	74 #/Ft
SATURATED SOIL	:	75 #/Ft³
CONCRETE	:	150 #/Ft³

$\frac{1}{4} = 22.25$

PIPE WEIGHT BASED ON ASBESTOS BONDED, FULL COATED



HEIGHT OF RISER : 17.5'

HEIGHT OF SOIL (Ave.) : 12.5'

E = EXTENSION

Problem: Complete Read THICKNESS OF BASE SLAB

New Jersey — CREAM RIDGE
C. Montana 6-70 HIM 6-16-70 NJ-31-391
RISER UPLIFT - CONT

TRIAL FOR E = 1 FT :

WEIGHT DOWN NOT INCLUDING CONC. SLAB :

RISER : 17.5 (150) = 2625

EARTH ABOVE SLAB AROUND RISER : FOR E = 1 FT.

(64 - 28.3)(12.5)(75) = 33,469

TOTAL = 36,094

UPLIFT NOT INCLUDING BASE SLAB :

28.3 (17.5) (62.4) = 30,904 lbs

DESIRED SAFTY FACTOR 1.5 : 1

WEIGHT REQ'D	1.5(30,904)	= 46,356
PRESENT WEIGHT		= 36,094
ADDITIONAL WEIGHT REQ'D		= 10,262

87(64) T = 10,262

T = 1.843 FT

IF T = FOOT WT ↓ = 87(64) 1.5 = 8352

SF = $\frac{36,094 + 8352}{30,904}$ = 1.44 : 1 OK .

New design
C. Montana 10-70 ADM [illegible] ID 0-0-691
Riser Uplift (cont.

TRIAL FOR E = 1.5 FT.

WEIGHT DOWN :

RISER :	2625
SOIL (E=1.5) : (81-28.3)(12.5)(75) :	49406
TOTAL	52031
UPLIFT :	30904

SAFETY FACTOR: > 1.5 : 1 WITH T = 0

TRIAL FOR E = 1.25 FT.

WEIGHT DOWN :

RISER :	2625
EARTH : (72.25-28.3)(12.5)(75)	41203
TOTAL :	43827
UPLIFT :	30904

ADDITIONAL WT REQD = 46356 - 43827 = 2528

THICKNESS : T = 2528 ÷ (57)(72.25)

T = 0.4 FT FOR SF = 1.5 : 1

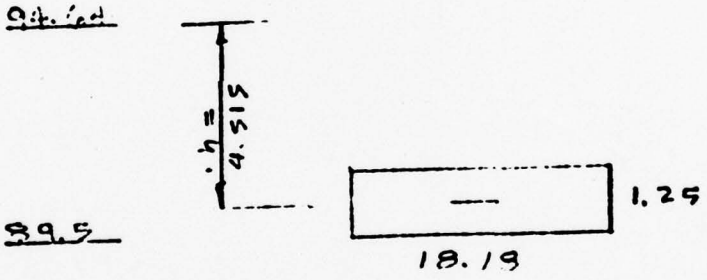
Conclusion : Go with E=1 FT., T= 1.5', SF 1.44:1

New Jersey — Stream Relief
C. M. 6-70 JLA 7-6-70 NJ-01-691
Placement Of Anti-Vortex Device

Crest Of Principal Spillway	89.50
Pipe Primes At	90.90
Place Device At	90.75

∴ Height Of Opening = 1.25 Ft.
Length Of Opening = 18.18 Ft.
Area = 22.725 Ft

Design High Water = 94.64



$$Q = C A \sqrt{2gh}$$

$$= .6(22.73)\left[2(32.2)(4.515)\right]^{1/2}$$

$$= 232.0$$

232 > 116 OK

COMPUTATION SHEET
SCS-ENG-633 Rev. 8-69

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STATE		PROJECT			
N. J.		CREAM RIDGE DAM			
BY	DATE	CHECKED BY	DATE	JOB NO.	
JLA	6-16-70	CJM	6-16-17	NJ-01-691	
SUBJECT				SHEET	OF
AUXILIARY SPILLWAY					

Crest El @ 93.2 (assumed datum)

Design High Water = 94.64'

Depth of Flow = 94.64 - 93.2 = 1.44

Capacity of Principal Spillway @ 94.64 = 108 CFS

TOTAL Design Q = 224 CFS

∴ 224 - 108 = 116 cfs req for Aux Sp.

From ESNE 13, Sh. 3 of 9 Design Data for Earth Spillways. Pg 9.43

30 FT B.W — n = 0.040 for Sod

1.4 Ft depth — Side Slopes = 3:1 & 3:1

Capacity = 121 cfs. OK 121 > 116 cfs

Exit Velocity = 4.8 ft/sec

exit slope = ~~2.6%~~ min. toe 25 yr design Q = 3.5%

distance = 68 Ft.

level Control Section, 20 Ft. w/ concrete sill on downstream edge

APPENDIX 4

Hydrologic Computations

CREAM RIDGE POND DAM

SIZE CLASSIFICATION

Surface area of lake as measured from 200 scale sheets. } = 9.4 Acres

Total pool area as per records = 16 Acres

Maximum depth of lake = 18 Ft

Average depth of lake say 9 Ft.

Storage = 9.4 × 9 = 84.6 Ac-Ft

Maximum Storage = 16 × 9 = 144 Ac-Ft.

Maximum height of dam = 24 Ft

Therefore size classification catagory : SMALL

HAZARD POTENTIAL CLASSIFICATION

1. Dam situated in agricultural area.
2. Hazard to a secondary road situated approx. 4000 ft. downstream from the dam.
3. Hazard to limited agricultural land.
4. No loss of life expected

Therefore, hazard potential classification : LOW

100 YEAR FLOOD PEAK DISCHARGE

From special report #38

$$Q_{100} = 136\ A^{0.84}\ S^{0.26}\ S_t^{-0.51}\ I^{0.14}$$

1 Contributing drainage area = 1.42 Sq. Mi

2 Main Channel slope S = 45.7 Ft/Mi

3 Surface Storage Index S_t = 1 Percent

4 Manmade Impervious Cover Index I = 3.9 Percent

5 100 Year Flood Peak Discharge:

$$Q_{100} = 136\ A^{0.84}\ S^{0.26}\ S_t^{-0.51}\ I^{0.14}$$

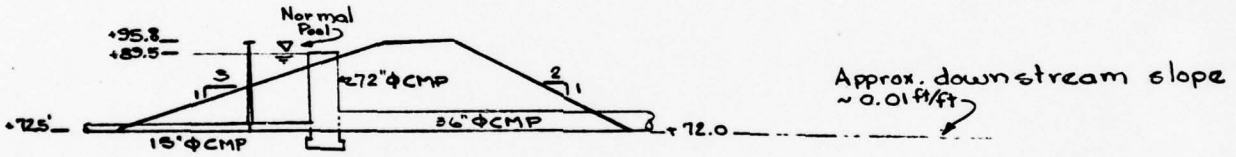
$$= 136\ (1.42)^{0.84}\ (45.7)^{0.26}\ (1)^{-0.51}\ (3.9)^{0.14}$$

$$= 136\ (1.342)\ (2.70)\ (1)\ (1.21)$$

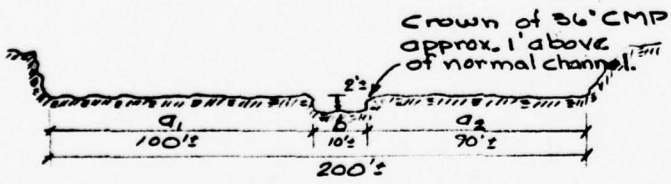
$$= \underline{597\ \text{C.F.S}}$$

SPILLWAY DISCHARGE

A brief trial calculation indicated that the SDF for Cream Ridge Dam will require both the primary and auxiliary spillways to accommodate the discharge. Furthermore, the primary spillway discharge is controlled by the 36 inch diameter outlet pipe during periods of high discharge, ie. when flow discharges over the auxiliary spillway.



-TYPICAL SECTION-
EARTHFILL EMBANKMENT



-TYPICAL SECTION-
DOWNSTREAM CHANNEL

a. Heavy weeds, scattered brush ⇒ n=0.06
b. Natural channel, regular section some grass & weeds ⇒ n=0.03

I. DOWNSTREAM FLOW CHARACTERISTICS-

A. FLOW IN CHANNEL "b" ONLY- (Re. "Design Charts For Open Channel Flow" U.S. Dept. of Commerce, 1961)

From Chart 9
Depth of Flow = 2'±
Slope ≈ 0.01 ft/ft
$Q_n = 3.6$
$Q = 3.6/0.03 \cong$ 120 cfs

B. FLOW IN CHANNEL & FLOODPLAIN AT CROWN OF 36"Φ CMP-

AD-A068 358 NEW JERSEY STATE DEPT OF ENVIRONMENTAL PROTECTION TRENTON F/G 13/2
NATIONAL DAM SAFETY PROGRAM. CREAM RIDGE DAM (NJ00252), DELAWAR--ETC(U)
APR 79 R J MCDERMOTT DACW61-78-C-0124

UNCLASSIFIED NL

2 OF 2
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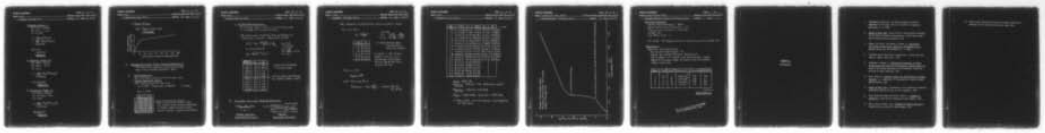
A068358



END
DATE
FILMED
6-79
DDC

1. CHANNEL AREA a_1 -

$A = 1(100) = 100$ SF

$WP = 100 + 1 = 101$ FT.

$S = 0.01$ FT/FT

$$V = \frac{1.49}{n}(R)^{2/3}(S)^{1/2}$$
$$= \frac{1.49}{0.06}(100/101)^{2/3}(0.01)^{1/2}$$
$$= 2.5 \text{ FPS}$$

$$Q = VA$$
$$= 2.5(100)$$
$$= \underline{\underline{250 \text{ CFS}}}$$

2. CHANNEL AREA a_2 -

$A = 1(90) = 90$ SF

$W = 90 + 1 = 91$ FT

$S = 0.01$

$$V = \frac{1.49}{0.06}(90/91)^{2/3}(0.01)^{1/2}$$
$$= 2.5 \text{ FPS}$$

$$Q = 2.5(90)$$
$$= \underline{\underline{225 \text{ CFS}}}$$

3. CHANNEL AREA b -

$A = 3(10) = 30$ SF

$W = 10 + 2 + 2 = 14$ FT

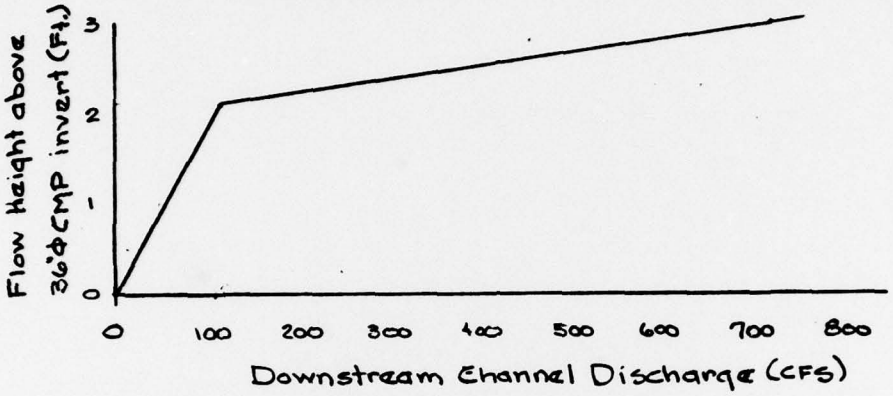
$S = 0.01$

$$V = \frac{1.49}{0.03}(30/14)^{2/3}(0.01)^{1/2}$$
$$= 8.3 \text{ FPS}$$

$$Q = 8.3(30)$$
$$= \underline{\underline{249 \text{ CFS}}}$$

4. TOTAL FLOW

$Q_T = 250 + 225 + 249$
$= \underline{724 \text{ CFS}}$



II. PRIMARY SPILLWAY FLOW CHARACTERISTICS-

72"ϕ Riser Pipe acts as a sharp crested weir with a crest length(L) = 18ft.

A. INLET CAPACITY-

(Re. "Handbook of Hydraulics", H.W. King, etal., 1963)

1. SHARP CRESTED WEIR-

Use Rehbock formula (pg. 5-8)

$C = 3.235 + 1/(60H - 0.56) + 0.428 H/P$ P = 4' (avg.)

$Q = C L H^{3/2}$

	H (ft)	C	Q (cfs)	
90	0.5	3.32	21	
90.5	1.0	3.36	60	
91	1.5	3.41	113	← Riser pipe backed up to crest
91.5	2.0	3.46	176	Water surface ~1.75' above crest
92	2.5	3.51	250	(EL. +91.25). 36"ϕ controls discharge
92.5	3.0	3.56	333	in "outlet control" condition for
93	3.5	3.61	426	higher water surface elevations.
93.5	4.0	3.67	528	
94	4.5	3.72	639	
94.5	5.2	3.81	856	
95.2	6.2	3.91	1113	

2. 36"ϕ CMP CAPACITY=

Since the pipe is flat, it will always be in a state of "outlet control".

(Re. "Hydraulic Charts for the Selection of Highway Culverts" HEC Nº5, 1965)

$$H = \left[1 + K_e + \frac{29n^2L}{R^{1.33}}\right] \frac{V^2}{29}$$

$$H = 0.0499\,V^2$$

$$Q = \sqrt{20H}\,(7.07)$$

$K_e = 0.5$
$n = 0.024$
$L \cong 70'$
$R = \frac{7.07}{9.42} = 0.75$
$A = 7.07$

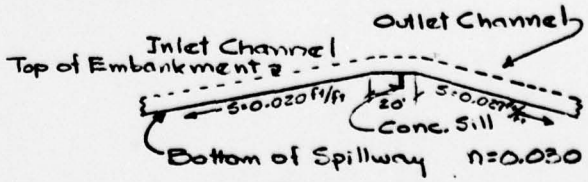
WATER EL INSIDE RISER (ft)	H (ft)	Q cfs
75.0	3.0	59.6
80.0	8.0	89.4
85.0	13.0	114
90.0*	18.0	134
91.0	19.0	138
92.0	20.0	141
93.0	21.0	145
94.0	22.0	148
95.0	23.0	152
95.8**	24.0	155

* 72"ϕ riser flooded
** El. dam crest

36"ϕ controls discharge for higher water elev's.

III. AUXILIARY SPILLWAY CHARACTERISTICS

-TYPICAL SECTION-
AUXILIARY SPILLWAY



-PROFILE-
AUXILIARY SPILLWAY

(Re. "Handbook of Hydraulics" H.W. King, et.al., 1963)

from pg. 8-16

$$S_c = \frac{14.56\, n^2}{D_m^{1/3}}$$

n = 0.030

D = 1' $D_m = \frac{33}{86}$ $r = \frac{30}{56.52}$

D = 2.6' $D_m = \frac{98.3}{45.6}$ $r = \frac{98.3}{46.4}$

$D_{(ft)}$	S_c
0.5	0.0116
1.0	0.0094
1.5	0.0083
2.0	0.0076
2.5	0.0071
2.6	0.0070

n = 0.025 (straight open channel, short grass, few weeds)

< 0.029 ∴ For all flow depths $S_o > S_c$ and discharge will equal Q max (pg. 8-18). Qmax occurs at D_c

from pg. 8-11

$$Q_{max} = K_c D_c^{5/2}$$

and from pg 8-17

$$D_{reservoir} = D_e + \frac{Q^2}{2gA^2}$$, where $D_e = D_c$, $Q = Q_{max}$

D_c (ft)	$y = \frac{D_c}{b}$	K_c	Q_{max} (cfs)	q (cfs)	D_r (ft)	b = 30'
0.5	0.01667	349.06	61.70	15.75	0.7383	93.9
1.0	0.03333	179.18	179.18	33.00	1.4578	94.7
1.1	0.03667	163.75	207.81	36.63	1.5998	94.8
1.2	0.04000	150.91	238.05	40.32	1.7413	94.9
1.3	0.04333	140.05	269.85	44.07	1.8822	95.1
1.4	0.04667	130.74	303.20	47.88	2.0227	95.2
1.5	0.05000	122.68	338.06	51.75	2.1626	95.4
1.6	0.05333	115.63	374.42	55.68	2.3022	95.5
1.7	0.05667	109.41	412.27	59.67	2.4413	95.6
1.8	0.06000	103.89	451.59	63.72	2.5799	95.8
1.9	0.06333	98.95	492.37	67.83	2.7182	95.9
2.0	0.06667	94.51	534.60	72.00	2.8561	96.1
2.1	0.07000	90.49	578.29			
2.2	0.07333	86.84	623.41			
2.3	0.07667	83.51	669.97			
2.4	0.08000	80.46	717.96			
2.5	0.08333	77.65	767.38			
2.6	0.08667	75.07	818.23			

$Q_{SDF} = 597$ cfs

$Q_{\text{Principal Spillway}} = 155$ cfs at El. 95.8 (dam crest)

$Q_{\text{Auxiliary Spillway}} = 452$ cfs at El. 95.8

$Q_{TOTAL} = 155 + 452 = 607$ cfs > 597 cfs

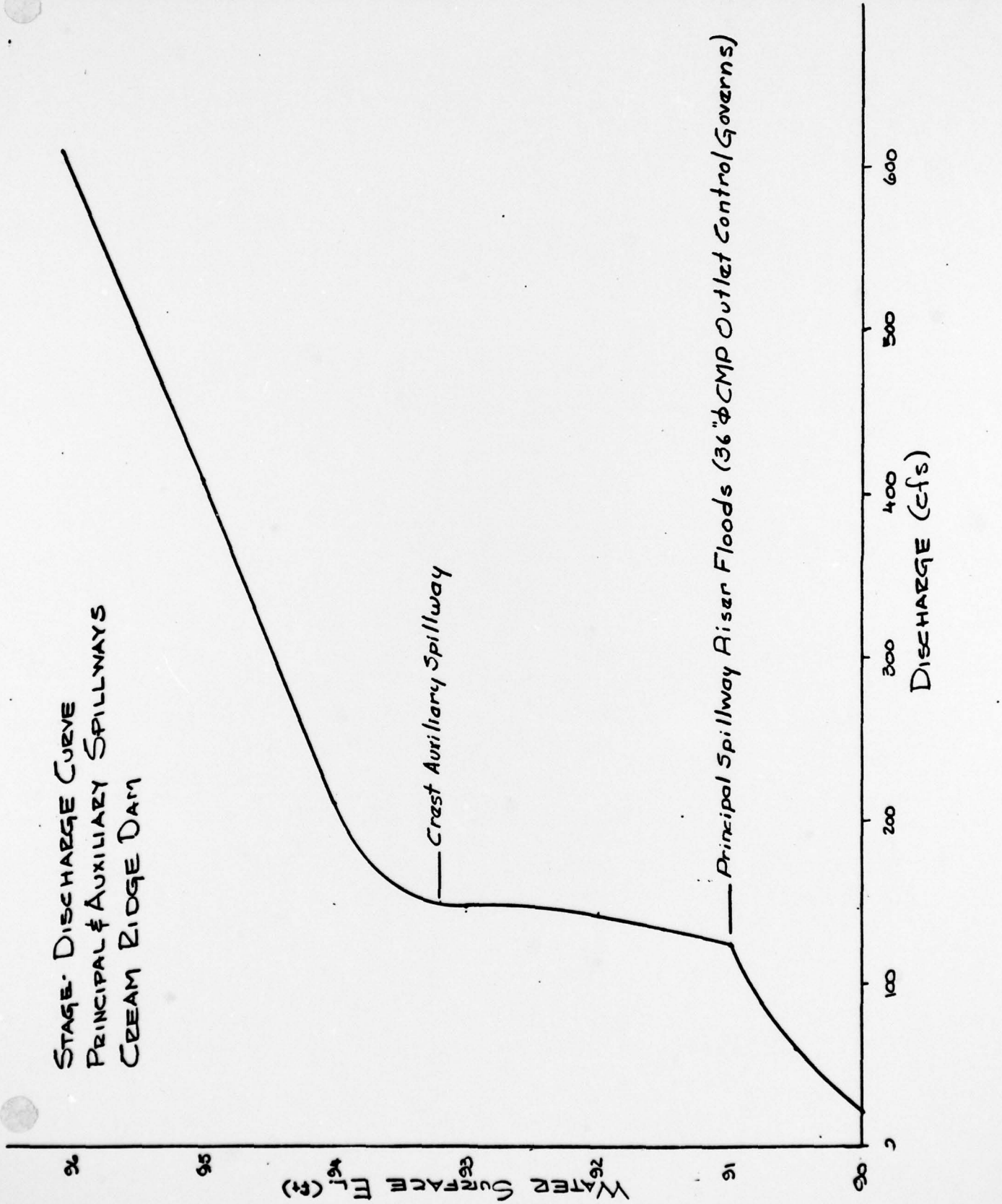
∴ The SDF will not cause overtopping of the dam.

STORCH ENGINEERS

Sheet 8 of 9

Project CREAM RIDGE DAM *1132 Made By EAW Date Feb. 23, 1979

DISCHARGE HYDRAULICS Chkd By RL Date 3-28-79



STORCH ENGINEERS Sheet ____ of ____

Project CREAM RIDGE DAM Made By EAW Date MAR. 29, 1979

OUTLET WORKS CAPACITY & DRAWDOWN Chkd By ____ Date ____

OUTLET WORKS -

Normal Pool Elevation = 89.5'
Outlet Works Invert Elevation = 72.5'
Assume entire length is 15" ϕ CMP
Length ≈ 130'
HW = 89.5 - 72.5 = 17'

Q = 12 cfs Re: "Design Charts For Open Channel Flow" U.S.D.C., 1961

DRAWDOWN -

Reservoir Characteristics -
Normal Pool Water Depth = 17'
Approx. Normal Pool Storage = 85 acre-ft.
Use 4 steps of 4' each and the average water depth during each step to determine the outflow rates and time.

Step	H_{avg} (ft)	Q_{avg} (cfs)	Volume (cf)	Time (hrs)	Cumulative Time (hrs)
1	15	11	1,383,466 (7.94) (5.82)	35	35
2	11	10	1,014,077 (3.71)	28	63
3	7	8	646,430 (1.59)	22	85
4	3	5	277,042	15	100

4.2 days
Say, 5 days

APPENDIX 5

Bibliography

1. "Recommended Guidelines for Safety Inspection of Dams," Department of the Army, Office of the Chief of Engineers, Washington, D. C. 20314.

2. Design of Small Dams, Second Edition, United States Department of the Interior, Bureau of Reclamation, United States Government Printing Office, Washington, 1973.

3. Holman, William W. and Jumikis, Alfreds R., Engineering Soil Survey of New Jersey, Report No. 19 Monmouth County, Rutgers University, New Brunswick, N. J. 19545.

4. "Geologic Map of New Jersey" prepared by J. Volney Lewis and Henry B. Kummel, Dated 1910 - 1912.

5. Stankowski, Stephen J., Magnitude and Frequency of Floods in New Jersey with Effects of Urbanization, Special Report 38, State of New Jersey Department of Environmental Protection. Division of Water Resources, 1974.

6. Herr, Lester A., Hydraulic Charts for the Selection of Highway Culverts, U.S. Department of Transportation, Federal Highway Administration, 1965.

7. Safety of Small Dams, Proceedings of the Engineering Foundation Conference, America Society of Civil Engineers, 1974.

8. King, Horace Williams and Brater, Ernest F., Handbook of Hydraulics, Fifth Edition, McGraw-Hill Book Company, 1963.

9. Davis, Calvin Victor, (Ed.), Handbook of Applied Hydraulics, Second Edition, McGraw-Hill Book Company, 1952.

10. Plans titled "Construction Plans and Design Calculations", prepared by Soil Conservation Service, dated 1970.